In Turbulent Seas:

The Status of Philippine Marine Fisheries

Department of Agriculture
BUREAU OF FISHERIES AND AQUATIC RESOURCES

In Turbulent Seas: The Status of Philippine Marine Fisheries

DA-BFAR
2003

In Turbulent Seas: The Status of Philippine Marine Fisheries

Department of Agriculture-Bureau of Fisheries and Aquatic Resources

With assistance from:
Coastal Resource Management Project
of the
Department of Environment and Natural Resources
supported by the
United States Agency for International Development

Philippines

In Turbulent Seas:
The Status of Philippine Marine Fisheries

Department of Agriculture, Bureau of Fisheries and Aquatic Resources

2004

Printed in Manila, Philippines.

Citation:
DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). 2004. In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines, 378 p.

This publication is made possible through support provided by the United States Agency for International Development (USAID) under the terms and conditions of Contract No. AID-492-C-00-96-00028-00. Additional support for printing has been provided by the Philippine Environmental Governance Project (EcoGov) of the Department of Environment and Natural Resources (DENR), supported by USAID and by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH on behalf of the Federal Republic of Germany through its Visayan Sea Coastal Resources and Fisheries Management (VisSea) Project.

Cover: *(Top to bottom)* Fishers clearing net (S.J. Green); fish on ice (S.J. Green); muro-ami fishing vessel (A. White); and coral reef and fish (E. Cu Unjieng).
(Backdrop) Calm seas at Ticao Pass, Masbate (A.E. Sia).

CRMP Document No: 02-CRM / 2004

ISBN 971-92753-4-0

Table of Contents

Acknowledgments

This book represents the collective effort of many individuals and organizations. The editors responsible for overall quality, introduction and conclusion are:

Geronimo Silvestre	Fisheries Specialist, CRMP
Stuart J. Green	Fisheries Component Task Leader, CRMP
Alan T. White, Ph.D.	Chief of Party, CRMP
Nygiel Armada	Associate Professor, University of the Philippines in the Visayas College of Fisheries and Ocean Sciences, and Fisheries Specialist, CRMP
Cesar Luna, Ph.D.	Fisheries Specialist, CRMP
Annabelle Cruz-Trinidad	Policy Component Task Leader, CRMP
Marciano F. Carreon III	Deputy Chief of Party, CRMP

Many government and nongovernment agencies and organizations have participated in the development and writing of this book through the authors whose affiliations are noted. A series of workshops have molded the overall content of the book and its policy directions summarized in the papers, introduction and conclusion. Those organizations with major contributions include:

Bureau of Fisheries and Aquatic Resources of the Department of Agriculture
Department of Environment and Natural Resources through the Coastal Resource Management Project and the Philippine Environmental Governance Project
University of the Philippines-Marine Science Institute
University of the Philippines in the Visayas

Marie Sol Sadorra accomplished copy editing and production coordination. Khristine R. Custodio did book design and layout. Rafael T. Martinez, Jimely O. Flores and Jessie O. Floren provided the maps; Khristine R. Custodio and Leslie S. Tinapay, the graphics; and Dexter Allen Besa, the artwork. Ysolde A. Collantes made the cover design. They are all of CRMP of Tetra Tech EM, Inc.

Foreword

The Bureau of Fisheries and Aquatic Resources publishes a Philippine Fisheries Profile on a yearly basis based on the latest available data gathered from field sites and fish trading activities around the country. This book, **In Turbulent Seas: The Status of Philippine Marine Fisheries**, enhances the information from the profile, integrates other aspects of the fisheries of the country not highlighted and, most significantly, gives a “snapshot” of fisheries in the Philippine context and looks at the health of the resource, the economics and socioeconomic situation of the country and selected fish stocks to gain a common understanding on what is happening to the fisheries. The book then goes on to look into the status of the implementation of fisheries management tools and how these have been applied in the country through various fisheries management projects that have been or are currently implemented. Furthermore, it looks at some key case studies from around the country, highlighting the successes and failures of various fisheries-related interventions.

As a developing nation, the Philippines is very dependent upon this natural resource, fisheries, for the livelihood of its coastal peoples, as the main supplier of animal protein to our fast-growing population, as well as its considerable contribution to the nation’s gross domestic product (GDP). If we are to continue to supply the country with export revenues, employment and food, then we perhaps must take a long good look at what is happening in the country’s fisheries as we move into the next decade.

I would like to congratulate the many authors and institutions that have assisted in this publication. I hope that we all use this publication to help us move into an age of fisheries management, for which this publication provides a clear basis and road map for how things should be in the future.

Malcolm I. Sarmiento, Jr.
Director
Bureau of Fisheries and Aquatic Resources
Department of Agriculture
Quezon City, Philippines

Preface

In Turbulent Seas: The Status of Philippine Marine Fisheries is the second in a series of fisheries management publications of the Coastal Resource Management Project. It provides a comprehensive snapshot of the current status of marine fisheries of the Philippines in all of their complexities. The book looks beyond the economics and production and covers the whole Philippine marine ecosystem and the status of the different sectors that have a stake in this potentially rich resource.

The book concept was developed through a series of meetings among key stakeholders, government and nongovernment organizations, academic institutions and private sector representatives who felt the need for a comprehensive compendium of the state of the country's fisheries and fisheries management interventions. These meetings were followed by a series of workshops to produce this timely publication. The editors and authors have attempted to include all the different Philippine fishery sectors through a variety of stakeholder groups with many perspectives.

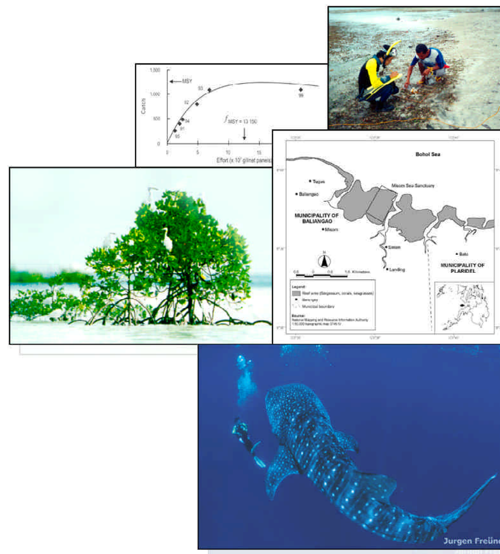
Philippine fisheries, renowned for their biodiversity and value, but generally in a very poor state of "health", are described herein. There is an urgent need for better management and protection of these resources that contribute substantially to the country's economy and the livelihood of several million people. These resources are essential to the country's food security and the subsistence of some of the most marginalized people in Philippine society.

Finally, this book is attributed to the various specialists, technical experts and scientists who participated in the meetings and workshops. The editors would like to thank each contributor personally. The title, "In Turbulent Seas…" reflects the reality of fisheries in the country today. The editors have attempted to provide a balanced view of the complex issues while looking at the many proposed solutions to fisheries management. The glimmer of hope seen in the case studies needs to be extended nationwide. Let us all read and make use of this publication with all of its ramifications for improved fisheries management in the Philippines!

The Editors

SECTION I

General Introduction and Overview



Profiling the Status of Philippine Marine Fisheries: A General Introduction and Overview[1]

CESAR Z. LUNA
GERONIMO T. SILVESTRE
STUART J. GREEN
MARCIANO F. CARREON III
ALAN T. WHITE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Background

The term "marine fisheries" refers to the extraction of wild living resources in coastal and open seas in the service of human needs or markets. Marine fisheries resources include numerous fishes as well as invertebrates such as crustaceans, mollusks and sea cucumbers. In the Philippines, two distinct sectors comprise marine fisheries - a large-scale or commercial sector and a small-scale sector, which is also called artisanal or municipal sector. The Philippine Fisheries Code of 1998 defines municipal fishing as fishing without using vessels or with vessels of 3 GT or less. Fishing with vessels of more than 3 GT is considered commercial fishing. Legally, commercial fishing is restricted to areas outside municipal waters or waters beyond 15 km from the shoreline.

The country's marine fisheries provide various economic and social benefits. In 2001, the sector produced 1.8 million t of fishes and invertebrates, or 57% of the total fish production (Figure 1), which was valued at P67.4 billion (BAS 2002). The country's capture fisheries production (including inland fisheries) ranked 13th in the world (FAO 2002). Through exports consisting mainly of tuna, octopus, crab and crab fat, the marine fisheries sector earned at least P10.7 billion in foreign exchange for the country (BAS 2002). In 1997, the municipal and commercial fisheries sectors directly employed 675,700 and 56,700 fishers, respectively, and generated additional employment in ancillary activities such as fish processing, marketing and boat building (Barut *et al.* 2001). More than half of the animal protein in the average Filipino diet comes from fish (Espejo-Hermes, this vol.). With its contribution to employment and food security, the marine fisheries sector is a major factor that maintains economic and social stability, particularly in rural areas where fishers reside.

Despite their social and economic importance, however, many problems beset Philippine marine

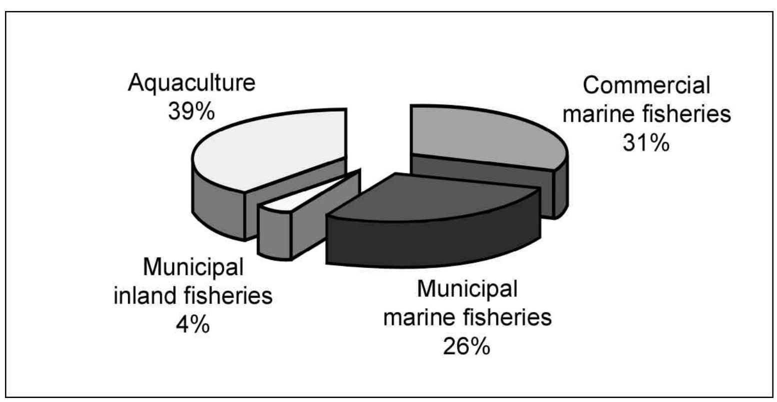


Figure 1. Contribution by sector to total Philippine fisheries production in 2001. Marine fisheries contributed more than half of the total fish production by volume (BAS 2002).

[1] This paper can be cited as follows: LUNA, C.Z., G.T. SILVESTRE, S.J. GREEN, M.F. CARREON III and A.T. WHITE. 2004. Profiling the status of Philippine marine fisheries: A general introduction and overview, p. 3-11. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

fisheries. These include declining catch rates that are symptomatic of overharvesting, degradation of critical coastal habitats, intense conflicts among resource users, poverty among artisanal fishers and increasing food deficiencies with dire implications for economic and social stability in rural, coastal areas of the country. Over the years, these problems have intensified and spread through most of our coastal and marine areas. As these problems have worsened and become national in scope, the need to formulate and implement a program of integrated action and coordination to remedy the situation has become extremely urgent. The available information, however, for this purpose is widely diffused and often in specialist language. They require effective translation and integration to promote consensus about the prevailing situation, effective management directions, and efficient operational uptake and programming by concerned agencies.

It is against this background that this profile, In Turbulent Seas: The Status of Philippine Marine Fisheries, was born. The Bureau of Fisheries and Aquatic Resources (BFAR) had regularly published (often annually) its series providing profiles of Philippine marine fisheries, briefly highlighting key trends and developments in the sector. The management of BFAR, however, recognizes the need to provide a deeper understanding of the prevailing marine fisheries situation in the country beyond the form and substance of the previous profiles. Hence, the current form of this 2004 version of the profile series. BFAR, in collaboration with the Coastal Resource Management Project (CRMP, which is funded by the United States Agency for International Development) of the Department of Environment and Natural Resources, assembled key experts and stakeholders from the fisheries and marine science community in the country to provide a synoptic picture of the prevailing marine fisheries situation and viable directions for their improved management. BFAR believes this is an essential step in informed consensus-building and concerted action for integrated coastal management and sustainable fisheries. We elaborate below the rationale, process and conceptual framework resulting into this book, and provide a brief glimpse of the various contributions.

Rationale for the Profile

Turning the tide for Philippine marine fisheries requires a concerted, nationwide effort in which all stakeholders - fishers, resource managers, policymakers, research institutions, nongovernment organizations (NGOs) and others - will have key roles to play. Such a concerted action to address the myriad issues and challenges of Philippine marine fisheries should be based on a comprehensive analysis of its status. Yet the information dealing with marine fisheries remains scattered among various research institutions and agencies in different forms such as data, field reports and assessments. Furthermore, these studies and assessment reports are often incomprehensible to many stakeholders. Typically, such reports focus on specific aspects or situations in marine fisheries, thus leaving to their potential users the task of connecting their significance to the larger picture. Moreover, these reports often fail to translate the management implications of their findings into useful courses of action for management authorities. Clearly, there is a need to systematically select useful information and consolidate them into a composite picture that is sufficiently comprehensive for effective action. Moreover, the consolidated information should be translated into a form and language easily understood by a wider audience.

The main purpose of this profile is to provide a synoptic picture of the status, problems and directions for improved management of Philippine marine fisheries and other coastal resources. Moreover, it is intended as a comprehensive yet handy reference volume usable to the wider audience of fisheries and coastal resource stakeholders interested in sustaining the benefits derived by the country from its marine resources. Specifically, the profile seeks to:

- provide a concise yet comprehensive view of the status of Philippine marine fisheries - resources; environment and resource users; social, cultural, economic and ecological aspects; as well as the policies and currently available tools for resource management;
- identify appropriate management directions or objectives for Philippine marine fisheries given their current status and evident future trends; and
- explore viable interventions to achieve our fisheries management objectives and sustain the benefits derived by the country from its marine fisheries.

Given the highly participatory nature of the profiling process, which involved a wide array of institutions and stakeholders, the profile also seeks to establish a wider constituency for fisheries reforms and concerted action for sustainable fisheries in the country. Concededly, this requires continuous efforts. BFAR and its partners have every intention to sustain such efforts through future updates of the profile and related follow-up actions in the area of information and education.

The Profiling Process

Given the above-mentioned objectives for the profile, BFAR and CRMP initiated the profiling process by sponsoring a multisectoral meeting attended by resource managers, policymakers, and representatives of research institutions and NGOs in Manila in September 2002 (Figure 2). This was the first in a series of three workshops. Each invited representative presented the thrust and current activities of their respective organization, particularly with regard to marine fisheries. These presentations confirmed that a substantial amount of information on various aspects of marine fisheries exists. Subsequently, BFAR and CRMP staff presented the rationale and tentative outline of the profile. Workshop participants then divided into working groups to discuss issues and identify information gaps. The outputs of the working groups helped improve the profile outline and provided inputs to a then evolving conceptual framework. Finally, the participants identified topics in the outline that were within their areas of expertise and volunteered to write short articles on these topics.

The contributors who volunteered in the first workshop were invited to the second workshop in Cebu City in March 2003. Over three days, the contributors wrote their first drafts. Technical editors were also assigned to oversee each section of the profile. From then on, contributors worked with the technical editors until the completion of their individual papers.

Also during the second workshop, a draft fisheries management framework was presented to the participants that contained a network of issues, fisheries management objectives and recommended interventions. A third and final workshop was held in May 2003 in Manila to finalize the fisheries management framework as well as a consensus statement summarizing the key recommendations of the authors and other participants in the profiling process.

The profiling process used and its mode of implementation holds several advantages for fisheries in developing countries like the Philippines. The highly participatory mode used, involving numerous experts and stakeholders in each aspect of marine fisheries (see Appendix 1 to this volume which provides a list of participants during the profiling process and their institutional affiliations), allows for more robust diagnosis of the relevant status and directions for fisheries, especially on particular resource groups. Cross-validation of data, analyses and conclusions across local experts with first-hand and extended knowledge of national and local fisheries contributed to more robust and informed results. Moreover, given the paucity of information and short history of quantitative fisheries research characteristic of fisheries in developing countries, the resort to multiple experts and stakeholders effectively helps overcome shortcomings in information availability (and access). This promotes the use of the "best available scientific evidence", facilitates arrival at consensus (and where such cannot be achieved) and helps overcome inaction in the face of (real or imagined)

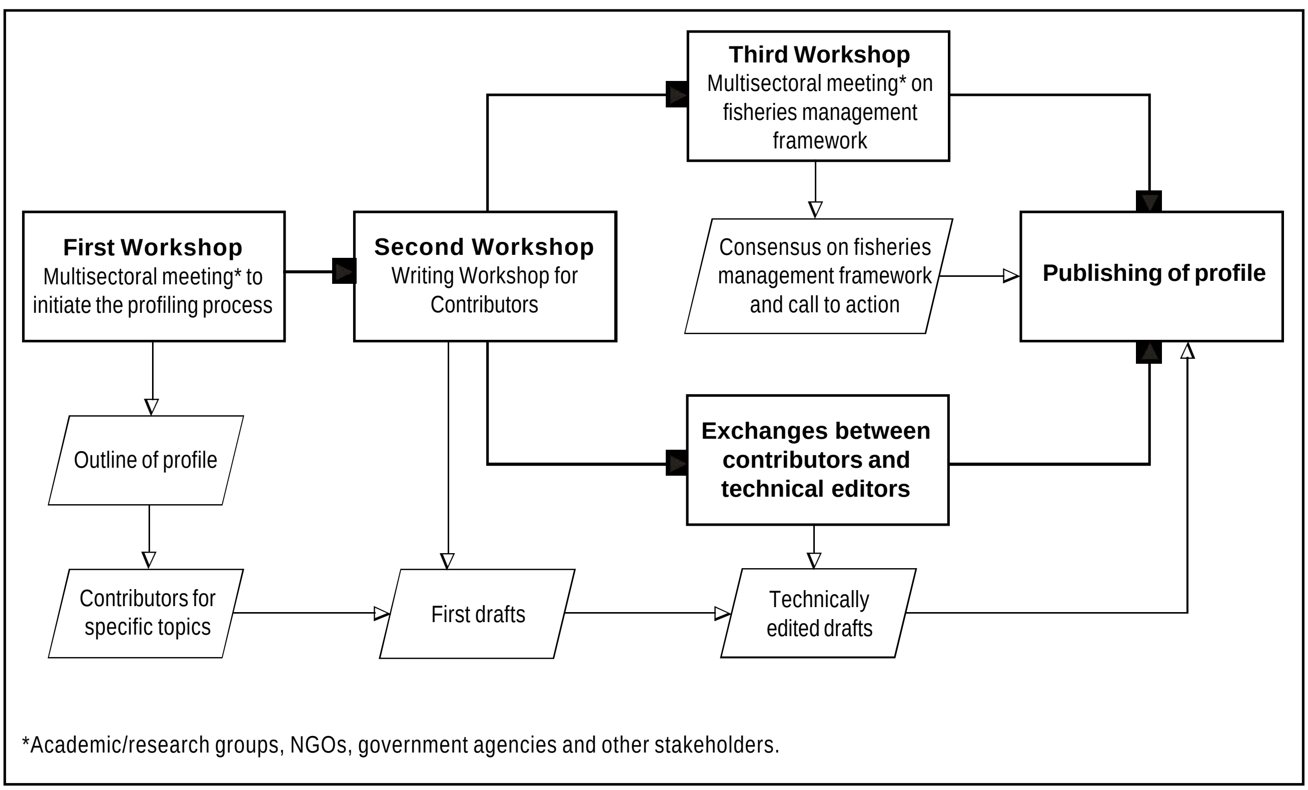


Figure 2. The profiling process.

information scarcity within the bounds of the precautionary principle.

Throughout the profiling process, particularly during the workshops, the enthusiasm of the volunteer contributors and the workshop participants was evidently very strong. In the seriously troubled sector that is Philippine marine fisheries, the willingness of this community to come together is one sign that offers great hope for the future.

Conceptual (Marine Fisheries "System") Framework

Our response to the challenge of sustaining marine fisheries will be determined to a large extent by how we view what constitutes relevant parts of the whole marine fisheries "system". As the saying goes, "out of mind, then out of sight". Our perception of the "world" of marine fisheries, the "mental maps" we draw of what constitutes parts of such a "system", determines our definition of relevance and scope of marine fisheries "reality". Such perception (or cognition) determines, among others, effective diagnosis of the full set of problems, the range of relevant management prescriptions, and effective communication among stakeholders. Moreover, such perception of the marine fisheries "system" is usually conditioned, among others, by our values and norms, disciplinary trainings and life experiences. There are thus many ways in which the marine fisheries "system" may be defined. We offer below a view of the marine fisheries "system" we believe to be sufficiently comprehensive for purposes of the book, and one which facilitates effective communication and problem / solution identification. A realization from past fisheries management failures is that we must adopt an integrated coastal management approach. This is needed to address both the direct fishery issues as well as the contextual issues that are undermining fisheries worldwide.

We start detailing the elements of our marine fisheries "system" with a simple (and conventional) way of looking at fisheries as given in Figure 3. While this traditional framework is simplistic and lacks many details, it is valuable in expanding on general basic principles of fisheries management. This framework recognizes and illustrates the basic interdependence between the economic activities collectively labeled as "fisheries" (the capture sector) and the fisheries resources (various aquatic plants and animals) to sustain the flow of goods (i.e., catches) and benefits (e.g., nutrition, incomes, employment, export receipts) we derive from marine fisheries. The framework also recognizes that the fisheries resources emanate from,

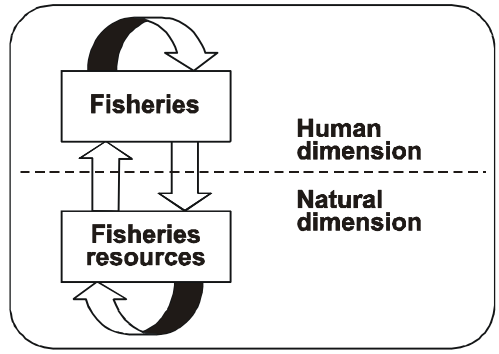


Figure 3. Schematic representation of the conventional view of a fishing "system" (adapted from Silvestre 1996).

and are sustained by, natural processes and habitats (i.e., the natural environment). Moreover, the framework recognizes that fisheries form part of (and are influenced by) the larger social, economic and political realities and processes (as mediated by institutions) of the human dimension. Given this background, it is widely accepted that fisheries management authorities should: (1) establish fisheries or exploitation regimes that optimize and do not impair the sustained flow of goods and benefits derived from the fisheries resource base, in conjunction with all coastal resources that interface with fisheries; (2) promote the harvest of resources in a responsible manner that does not damage the resource base and its supporting natural environment; (3) promote equity of the exploitation regime and the distribution of benefits derived from marine fisheries; and (4) promote efficient and effective institutions (i.e., to include customs, laws, policies and organizations) that can ensure sustained productivity, equity, environmental integrity and optimum value to society (in the broad sense) from our marine fisheries and coastal resources. We encourage the readers to keep these management principles and objectives in mind as they go over the various contributions to this compilation.

From our simple framework in Figure 3, we can detail the marine fisheries "system" framework for purposes of the current book. We do this by elaborating the components of our rudimentary fishing system in Figure 3, recognizing the inherent complexity of the fisheries system. We elaborate the details only to the extent that helps clarify our thinking, particularly with regard to policy directions. Working on the natural dimension, we begin by recognizing the distinct types of fisheries resources - invertebrates, demersals, pelagics and so on (Figure 4). We also recognize that these resources are sustained by the marine environment - particularly critical habitats and ecosystems, such as mangroves, seagrasses and coral reefs, and habitat characteristics such as water quality.

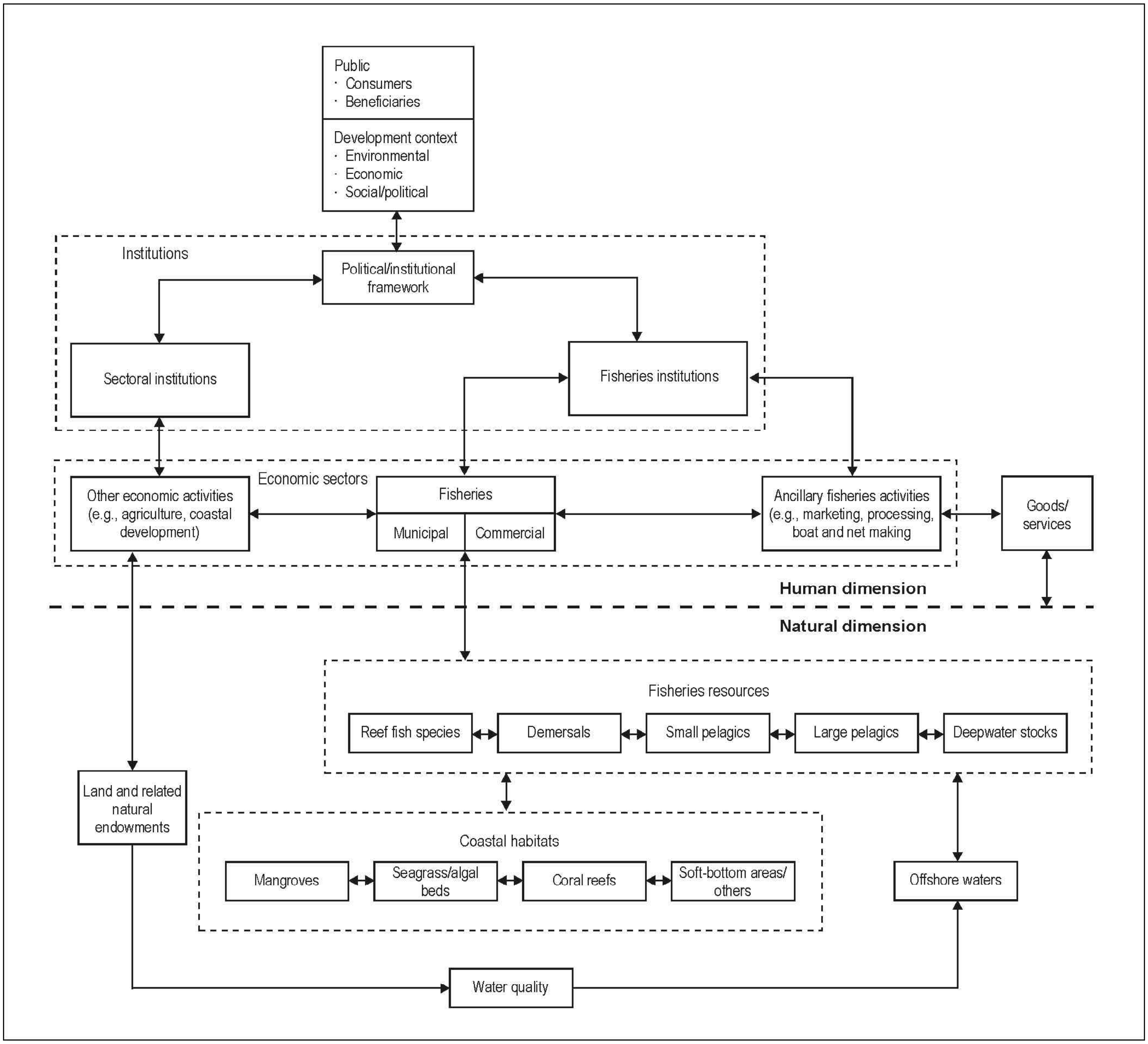


Figure 4. A systems view of the fisheries, the resources they exploit, the habitats that sustain the resources and other relevant components of the human and natural dimensions. This conceptual or "system" framework guided the development of the current profile on the status of Philippine marine fisheries (expanded from Silvestre 1996).

Turning our attention to the human dimension, we separate fisheries into its commercial and municipal sectors, thus, recognizing the characteristic duality of Philippine fisheries. We also recognize other economic activities that interact with the fisheries and have their own impacts on the marine and coastal environment.

In addition to a more detailed specification of the fisheries, other economic sectors, fisheries resources, and various components of the coastal and marine environment, the "system" framework in Figure 4 also accounts for the institutions that regulate and influence the economic sectors that directly or indirectly utilize fisheries resources and/or impact on the marine environment. This is so because our aim is to consolidate information that may be the basis of effective policy. Finally, the uppermost box in Figure 4 reminds us that the status of Philippine marine fisheries is influenced by the larger development context of the country. Currently, this development context is characterized, among others, by conditions of economic underdevelopment, inequity, high population growth, widespread poverty and weak institutions – leading to what many social scientists refer to as a crisis in the "structure of opportunities" (David 2002) in Philippine society.

The marine fisheries "system" framework detailed in Figure 4 principally guided the selection of papers included in this profile. It is sufficiently comprehensive for purposes of the rationale and objectives for coming up with the profile. We note that it is scale-independent, and thus may be used at different spatial scales (i.e., from national to local) as appropriate. We encourage the readers, for purposes of tractability, to use this "system" framework as they go over the various contributions to this compilation. Situating the relevant aspect of marine fisheries being discussed by a contribution in this "mental map" will facilitate getting the composite picture of the whole "system". We revisit the basic principles / objectives and the "system" framework (Figures 3 and 4) in the last section of the profile when we draw together and summarize the main policy implications of the various contributions to the challenge of restoring the "structure of opportunities" in the Philippine marine fisheries sector.

Overview of Profile Contents

This profile contains papers contributed by various authors that describe the elements of our conceptual framework in Figure 4. The papers are divided into five sections, which are briefly outlined below.

Section I: General Introduction and Overview

This section contains this paper, which introduces the profile and provides an overview of its rationale / objectives, elaboration process, conceptual framework and contents.

Section II: Status of Marine Fisheries and Habitats

The papers in Section II elaborate on the status of various marine resources (as well as critical marine habitats and habitat characteristics), the fisheries on these resources and the ancillary fisheries activities in our conceptual framework (Figure 4). The socioeconomic condition of fishers and members of fishing households – key stakeholders in the marine fisheries sector – are also covered.

Two reprints start off the section to provide the context. Daniel Pauly traces the development of Philippine marine resources research from the Spanish period to the mid-1980s to provide an historical perspective to the volume. Note here, among others, that although overfishing was already a matter of concern in the 1970s, the policymakers of the 1980s who needed a national assessment of marine fisheries had no recourse but to rely on expert opinion. Noel Barut *et al.* provide a brief sectoral update covering the environment, fisheries production trends, and issues and opportunities in Philippine marine fisheries using data and studies available up to mid-1990s.

The next papers focus on the status of particular types of fisheries in the country and the resources they exploit. Ester Zaragoza *et al.* contribute two papers, one on small pelagic fisheries and the other on fisheries on tuna and other large pelagics. Nygiel Armada consolidates data and literature on the major trawlable fishing grounds from as early as the 1940s up to the present to determine the status of demersal resources. He quantifies the decline in biomass and documents evident changes in species composition. Jose Ingles describes one of the most economically important invertebrate fisheries, that of blue crab *Portunus pelagicus*. Samuel Mamauag writes about the largely export-oriented trade in live food fish, such as groupers and other species caught from reefs, including the ecological impacts of the trade. Domingo Ochavillo *et al.* describe the marine aquarium fish trade, a foreign exchange earner that is sadly associated with cyanide fishing. Porfirio Aliño *et al.* investigate coral reef fisheries, noting that catch rates are among the lowest in the world. Rudolf Hermes documents the capture fisheries for larval and juvenile fish, including various species involved, growth overfishing and bycatch problem. Jimely Flores describes a resource that is only beginning to be explored, that of the deep-sea.

The next set of contributions describes the state of the marine environment that sustains Philippine marine fisheries. Porfirio Aliño *et al.* make an integrative assessment of the critical fisheries habitats, such as coral reefs, seagrasses and mangroves. Alan White and Roy de Leon present the status of mangroves and national policies for their management. They point to successful experiments in community stewardship that, if effectively replicated in other areas, offer hope of reversing the degradation trends. Miguel Fortes and Kristine Santos describe the status of seagrass resources, identifying increased population and eutrophication as the most significant threats to these resources. To determine the status of water quality in the country's fishing grounds, Maria Lourdes San Diego-McGlone *et al.* consolidate water quality assessments of 12 Philippine bays. They review past studies in Manila Bay to document the progression of impacts caused by increasing population. They do the same for Bolinao, Pangasinan, to elucidate the impacts of mariculture development. Moonyeen Alava and Jose Cantos review the status of vulnerable or endangered marine species, including sea turtles, dugongs, cetaceans, whale sharks, mantas and seahorses, reflecting the combined effects of intense exploitation and habitat degradation on these resources.

Two papers describe the most important ancillary fisheries activities. Glenn Aguilar describes the current fishing boat making industry as largely a backyard industry that produces boats without the benefit of engineering design. He summarizes the size structure of fishing boats, essentially profiling the composition of fishing effort in the country. Jasmin Espejo-Hermes describes the fish processing industry, including the trend towards increased mechanization and increasing reliance on imported fish.

The socioeconomics of fisheries is also covered in Section II. Ralph Townsend explains concepts used in fisheries economics, such as maximum sustainable yield, maximum economic yield, open access, limited entry and individual transferable quotas. He shows that any combination of fisheries management measures, including those that have been tried so far in the Philippines, will ultimately fail without mechanisms to limit entry. Danilo Israel reviews the economic performance of the fisheries sector and the socioeconomic conditions of fishers, noting the decline of productivity over time, the massive poverty among fishers and the economic losses from associated environmental problems. Ronet Santos reviews poverty in the context of Philippine fisheries, covering underlying causes and extent as well as fisheries interventions aimed at its alleviation. Ida Siason documents how women, though seldom involved in actual fish capture, conduct various support activities, such as securing credit that make fishing possible in the first place.

The section winds up with a reprint illustrating that the problems of overfishing and habitat degradation are not unique to the Philippines, and thus the folly of long-term reliance on imports and postponing effective management for domestic fish food security. Geronimo Silvestre and Daniel Pauly provide a survey of the regional fisheries management situation with emphasis on eight South and Southeast Asian countries (including the Philippines). They elaborate common biological and development features, issues and needs in the marine fisheries of these countries – generic trends which also provide the rationale for wider and cost-effective regional collaboration through sharing of lessons and effective management approaches.

Section III: Fisheries Management, Policies and Tools

Section III contains contributions covering the legal framework, organizations, policies, programs/ initiatives and tools related to fisheries management in the Philippines (i.e., the "institutions" part of the conceptual framework in Figure 4). The complex of institutions represents, among others, the instruments by means of which society seeks to attain its objectives in the fisheries sector and obtain optimum value for the nation (in the broadest sense). The effectiveness and efficiency of these institutions determine management success, and the current condition of marine fisheries illustrates the ability (or inability) of existing institutions to deal with the challenges of the prevailing situation.

William Jatulan provides an overview of national agencies and their role in various aspects concerning coastal and fisheries management. Tracing the evolution of fisheries policy, Jeneen Garcia sees hope in the progressive development from centralized management and apathy towards equity issues to the beginnings of true community-based management and the granting of preferential access to artisanal fishers. Rose-Liza Eisma tackles the question of how to source funds needed by local government units to finance the management of coastal resources within their jurisdictions. Currently, many regard municipal and city governments as the focal points for coastal and fisheries management. Nunila Pinat and Stuart Green highlight the role of the provincial government in management using Bohol as a case study. Illustrating the importance of actions by stakeholders and their organizations in improving management, Stanley Swerdloff describes the establishment of a federation of tuna fishers and other efforts of the Philippine tuna industry to organize and act.

The next papers cover important tools and/or activities for improved management of the country's marine fisheries. Marciano Carreon writes about the problems facing information management systems in fisheries, most of which are in their infancy. Hugh Trudeau analyzes the prospects of establishing a functioning municipal fisheries licensing system and identifies elements that must be in place if such a system is to have any real chance of being implemented. Edwyn Alesna *et al.* describe problems with the existing licensing system for commercial fishing. Nygiel Armada expounds on the theory behind minimum size regulations and discusses issues surrounding their application in Philippine fisheries. Marlito Guidote analyzes law enforcement, which is often the insufficient or missing element in attempts to manage fisheries.

Given the substantive potential ascribed to marine protected areas (MPAs) for improved management of fisheries and coastal habitats, five papers cover MPAs in Section III. Often the enhancement of fisheries is the stated objective for establishing MPAs; yet there are few studies that present rigorous scientific evidence of such enhancement. Among the few works that provide evidence of the positive effects of MPAs are those by Angel Alcala *et al.* on the Sumilon and Apo marine reserves, which are often cited in international literature. The reprint they contribute to this book summarizes the evidence of fishery enhancement contained in their many earlier publications. Porfirio Aliño *et al.* cover basic concepts associated with MPAs, provide a brief history of their use in the country and discuss recommendations to maximize their benefits. Rudolf Hermes points out that a provision in the Fisheries Code of 1998 allows for the establishment of MPAs beyond the 15-km jurisdiction of municipalities, yet to date fisheries management has not taken advantage of this provision. He identifies a shoal where such an offshore MPA could be established. Alan White *et al.* describe a system for monitoring the performance of MPAs that will facilitate comparison and help identify success factors in their establishment and management. Documenting the establishment of a network of MPAs in Misamis Oriental, William Adan describes the evolution of community reception from initial resistance to eventual participation and widespread support.

The next four papers cover other important tools for improved fisheries and their management. Ricardo Babaran discusses artificial reefs, which were a popular fisheries management tool in the past, and their close cousins, fish aggregating devices. Two papers explore the enhancement of invertebrate stocks. Marie Antonette Juinio-Meñez provides an overview of the use of this tool, while Johann Bell and Len Garces focus on the requirements of a responsible stock enhancement program and briefly describe current experiments with this management tool in the country. Monina Flores describes the successful establishment of a community-managed ecotourism venture that has minimized a community's dependence on fishing. She provides important perspectives in developing alternative livelihoods so important to viably reducing fishing capacity in coastal fisheries.

Section III ends with papers that deal with important management perspectives and policy issues. The problems in fisheries are partly the result of the relatively low priority given by the government to the fisheries sector. Rebecca Pestaño-Smith argues that advocacy and public education are the keys to reversing the current neglect of this sector. Virgilio Santos provides a brief discourse on policy trends with increasing "bias" in favor of municipal fishers. As an example of his provocative views, he regards the expansion of municipal waters as the unfortunate result of misinterpretations of the Local Government Code and past fisheries laws. Adelina Villena and Michael Pido deal with poaching in Philippine waters, with emphasis on intrusions by Chinese fishing vessels in the Palawan area. Joezen Corrales discusses the importance of fisheries management planning at the regional scale to integrate diffused local initiatives and documents the ongoing planning exercise for Region VII. Two papers discuss the evident need for integration of fisheries and coastal management. Rudolf Hermes explores the practicalities of making this integration a reality in the Philippine setting, while Michael Pido reviews the concepts of integrated coastal management and outlines the rationale for implementing fisheries management within this larger framework.

Section IV: Case Studies in Fisheries Assessment and Management

Section IV focuses on case studies in particular fishing grounds, covering various aspects of the conceptual framework in Figure 4 for specific areas / localities. These contributions provide site-specific examples reflective of the prevailing national marine fisheries situation.

Geronimo Silvestre and Vincent Hilomen document the status of two severely overfished embayments, the Lingayen Gulf (in northwestern Philippines) and San Miguel Bay (in the Bicol region along the Pacific coast of Luzon). Maribec Campos describes the situation in Lamon Bay (in Quezon Province) and, using bioeconomic modeling, evaluates alternative policies for fisheries in the area. Benjamin Gonzales writes about fisheries management in an area showing signs of full exploitation, Honda Bay in Palawan. Rudolf Hermes *et al.* describe the Visayan Sea Fisheries Resources Management Project, which is attempting to establish ecosystem-based management in a 10,000 km^2 area shared by four provinces in the Visayas. William Adan documents the case of an NGO that finally achieved success in its coastal management initiatives in Danao Bay when it shifted from a top-down to a bottom-up approach. To assess the effects of fisheries management interventions in Panguil Bay under the Fisheries Sector Program of BFAR, Marcelino Tumanda compares the situation in the 1990s before the introduction of interventions with the situation five years later, based on resource and ecological assessments conducted during the two periods. William Adan describes the situation in Gingoog Bay and how four municipal governments and one city government organized a council to coordinate coastal and fisheries management in the area. Nygiel Armada presents the status of fisheries in Davao Gulf as well as recommendations for their improved management based on an exhaustive assessment conducted in 1995. Finally, Jose Ingles and Romeo Trono describe the efforts of the World Wide Fund for Nature to initiate the management of the Sulu-Sulawesi Marine Ecosystem, a large marine ecosystem shared by the

Philippines, Malaysia and Indonesia. This case study illustrates that the Philippine marine waters are only part of a wider marine ecosystem and ultimately management, although difficult, should ideally move beyond the current geopolitical boundaries.

Section V: Conclusion and Recommendations

The last section contains a synoptic analysis of the key issues and recommendations resulting from integration of the various contributions outlined above. It also includes a statement from participants in the profiling process calling for urgent and concerted action towards improved management of the country's marine fisheries for the benefit of the current and future generations of Filipinos.

Conclusion

This profile is by no means perfect and can stand improvements in a number of ways. BFAR envisions improving the profile in future updates and the inputs of readers in this regard will be invaluable and highly welcome. Beyond the limitations, however, it should be noted that the fisheries and marine science community in the country has taken an important positive step on the road to sustainable fisheries and improved coastal resource management by means of this book. Let us not allow remaining limitations to get in the way of the consensus and real gains we have achieved thus far. These are critical times for Philippine coastal resources. The decisions and actions we make today will determine whether we can reverse the alarming degradation trends in this sector. Given the importance of fisheries and the marine environment to our nation, every Filipino is a stakeholder in these decisions.

This profile presents a wide range of topics and perspectives, and in coverage, it is indeed unprecedented in the country. Beyond providing information, it is hoped that it provides the foundation for serious reflections, debates, reforms and concerted actions toward sustainable fisheries. Moreover, it is hoped that this compilation will encourage the reader to participate in the discourse and concerted efforts to steer Philippine coastal resources towards sustainability and beyond its current condition of being "in turbulent seas". We encourage you to read on and experience the "gusts and turbulence" of the current situation, amidst the stories of hope, essential management directions and alternative visions for the future which the book presents.

References

Barut, N.C., M.D. Santos, L.L. Mijares and R. Subade. 200,1. Philippine coastal fisheries situation: A strategic review. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

BAS (Bureau of Agricultural Statistics). 2002. Fisheries statistics of the Philippines, 1997 - 2001. BAS, Department of Agriculture, Quezon City, Philippines. 74 p.

David, R.S. 2002. Nation, self and citizenship: An invitation to Philippine sociology. Department of Sociology, College of Social Sciences and Philosophy, University of the Philippines, Quezon City, Philippines. 368 p.

FAO (Food and Agriculture Organization). 2002. Yearbooks of fishery statistics summary tables – 2001. http://www.fao.org/fi/statist/summtab/default.asp.

Silvestre, G.T. 1996. Integrated management of coastal fisheries: Lessons from initiatives in San Miguel Bay, Philippines. ICLARM, Manila. 13 p.

SECTION II

Status of Marine Fisheries and Habitats

A Brief Historical Review of Living Marine Resources Research in the Philippines[1]

DANIEL PAULY[2]
International Center for Living Aquatic Resources Management
MCPO Box 2631, Makati City 0718
Philippines

Abstract

A review, starting with Spanish colonial times, is presented of research on the living marine resources of the Philippines. The first efforts were mainly taxonomic, with a gradual transition to the description of gears and fisheries. Biological studies were conducted mainly since the country's independence. Since the 1970s, increasing signs of resource depletion and destruction (especially in the case of coral reefs) have led to an increased awareness of the need for quantitative studies and for resources management.

Introduction

This contribution was written to fulfill three separate tasks:

1. to provide, as its title implies, a historical review of the study of marine living resources in the Philippines from colonial times to the present;
2. to provide access to the literature on those marine resources not covered by the other contributions included in this volume; and finally,
3. to provide a conceptual framework for these other contributions, each of which covers separate aspects of what actually should be viewed as a coherent whole.

The various sections of this contribution are arranged chronologically under headings characterizing the four periods that were identified.

The Spanish Period: Not Much Science

Although pre-Spanish lore and folklore contains a multitude of references to the closeness of the early Filipinos to the seas surrounding them, and to fish and fishing (see e.g., Ochotorena 1981), it is only with the onset of the Spanish colonial period that written materials became available which document this relationship. However, this documentation remained anecdotal (see entries to "fish and fisheries" in the Index, p. 400-401, of Blair and Robertson 1973) and at no time during the Spanish colonial period were works produced which even remotely matched those written, under circumstances otherwise similar to those in the Philippines, by say, Hamilton-Buchanan (1822) or Day (1875-1878) in the Indian subcontinent, or by Bleeker (see Lamme 1973) in what is now Indonesia.

In fact, most of the scientific contributions on Philippine marine resources were at that time written by European scholars of non-Spanish origin. Thus, for example, among the 44 references in Jordan and Richardson (1910), who published the first comprehensive checklist of Philippine fishes, only three were in Spanish; in the case of two of them, moreover, these authors felt compelled to write that "the identifications are not always trustworthy". The reasons for this lack of interest in the scientific investigation of natural resources have been laid out in masterly fashion by J.P. Rizal (1891), Philippine national hero and writer, in "The Class in Physics",

---

[1] This paper is a reprint of the full article which originally appeared as: PAULY, D. 1986. A brief historical review of living marine resources research in the Philippines, p. 3-18. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socio-economics of Philippine marine fisheries. Dep. Mar. Fish. Tech. Rep. 10, 217 p. (ICLARM Contribution No. 320).

This paper can be cited as above or as follows: PAULY, D. 2004. A brief historical review of living marine resources research in the Philippines, p. 15-21. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] Current address is: Fisheries Centre, The University of British Columbia, NW Marine Drive Research Station, 6660 NW Marine Drive, Building 022, Vancouver, BC, Canada V6T 1Z4.

i.e., Chapter 13 in “El Filibusterismo”, which comment on the state of science teaching at the eve of the last century:

> “Padre Millon” went deeply into science, knew the physics of Aristotle and Padre Amat, read carefully his “Ramos,” and sometimes glanced at “Ganot.” With all that, he would often shake his head with an air of doubt, as he smiled and murmured: *“transeat”*.
>
> “In regard to chemistry, no common knowledge was attributed to him after he had taken as a premise the statement of St. Thomas that water is a mixture and proved plainly that the Angelic Doctor had long forestalled Berzelius, Guy-Lussac, Bunsen, and other more or less presumptuous materialists. Moreover, in spite of having been an instructor in geography, he still entertained certain doubts as to the rotundity of the earth and smiled maliciously when its rotation and revolution around the sun were mentioned [. . .]. This was the professor who [. . .] called the roll and directed many of the students to recite lesson from [. . .] memory, word for word. The phonographs got into operation, some well, some ill, some stammering, and received their grades. He who recited without an error earned a *good* mark and he who made more than three mistakes a *bad* mark.”

Pannier (1982), writing on science in Latin America, noted – as did Rizal, but in a less entertaining style – that “the development of science during the colonial period was greatly inhibited for several centuries owing to the scant information transmitted from Europe on the advance of European scientific thought and to the prevailing religious dogmatism”.

The U.S. Period: Taking Stock

The prevailing attitudes were to change radically at the turn of the century. Early champions of U.S. rule in the Philippines were quick to agree that “the Philippines have been cursed by Spanish influence since the day of Magellan’s discovery” and that there was a need “for American citizens, with the welfare of their (!) country at heart, [. . . .] to familiarize themselves with the details and conditions in these new dominions and in the countries adjacent to them (White 1898).

And indeed the “details and conditions” soon began to pour out. In 1905, the results of a detailed census were published through which first quantitative information on numbers of fishers throughout the Philippines, and on their catch were made available (see Table 1 for an example of the numerous quantitative data one can find in that census report).

The data in fact allow for a first estimation of the catch per fisher at the beginning of the century, as can be obtained by dividing the number of fishers in the Philippines (Anon. 1905) by their catch, or 500,000 t per year/119,000 fishers = 4.2 t per year per fisher which is considerably more than the 1.3 t per fisher per year reported at present (see Smith *et al.* 1980), and not necessarily less accurate, given the lack of reliable statistics still prevailing to date.

Scientifically more important, however, was the systematic ichthyological work which Jordan and Richardson (1910) initiated, which A.W.C.T. Herre continued and which, finally, led to the emergence of a distinguished group of Filipino ichthyologists (H.A. Roxas, A.F. Umali, P.R. Manacop, H.R. Montalban, D.V. Villadolid and others).

Table 1. Number of fishers in 1903 in the Philippines by “race” and sex according to the first US census (see Anon. 1905).[a]

Brown		Mixed		Yellow		White		Black		Total
♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂ + ♀
111,159	5,536	27	1	62	-	11	-	3	1	116,799[b]

[a] Thus, according to this census, there were in the Philippines, in 1903, 27 “mixed”, 62 “yellow”, 11 “white” and 3 “black” fishers as well as 5,536 “brown” and 1 (!) “mixed” female fisher (!). It is a pity no details are available on how their “race” was assessed. This table also illustrates into which intellectual swamp one can be misled by preconceived ideas.

[b] Close to the total figure of 119,000 used elsewhere in the census report and in this paper.

The task ahead of this group was the collection, description and classification of the some 2,400 marine fish species of the Philippines – the most diverse fish fauna in the world. By the onset of World War II, this task was essentially completed (see Herre 1953).

Most of the publications which emerged from this work have been reprinted in four handy volumes by TFH Publications for the Smithsonian Institution (Philippines Bureau of Science Monographic Publications on Fishes, 1 volume, and Selected Ichthyological Papers from the Philippine Journal of Science, 3 volumes).

This was fortunate because the war, which scattered the members of the school, also led to the complete destruction of the ichthyological collections and library of the Bureau of Fisheries (Herre 1953), a blow from which fish taxonomy in the Philippines never fully recovered.

Philippine Independence and Post-war Reconstruction

Post-war reconstruction and independence from USA required, with regard to marine resources, more than the somewhat esoteric work that had been conducted before: they required the quantitative assessment of resources. The emphasis of marine research which had been centered on taxonomy thus became explicitly fishery-oriented, and a number of still valuable reports were issued under a rehabilitation program executed by staff of US Fisheries and Wildlife Service, working with 2 staff of the Philippine Bureau of Fisheries (see e.g., Umali and Warfel 1950 or Warfel and Manacop 1950). Blanco and Montalban (1951) give a bibliography covering this period.

In the late 1950s, Dr. K. Tiews, working for a fisheries project of the Food and Agriculture Organization of the United Nations (FAO), added to these efforts, and a large number of publications covering major fishing grounds and resource species of the Philippines were published by him and his associates, notably I.A. Ronquillo and by other Filipino researchers. This period lasted approximately to the end of the 1960s. The role of fisheries in the Philippine economy of this period and the problems of the sector were summarized by Storer (1967).

Tiews (1958) presented a brief account of fishery-related research in the Philippines up to this period, and which is particularly pertinent to the topic of this contribution:

"The first marine research in the Philippines dates back 160 years, and since then the main efforts of researchers of many nations have been directed to identifying the very rich fauna of the archipelago. Albert W. Herre, in his Check List of Philippine Fishes [. . .] records no less than 2,277 fish species grouped in 205 families and 716 genera. Oceanographic research by deep-sea expeditions in the Philippine Archipelago has contributed greatly to knowledge of the area. Most noteworthy are the British "H.M.S. Erebus and Terror" (1839-43), the Spanish frigate "Navarra" (1857-58), the British "H.M.S. Challenger" (1872-76), the U.S. fisheries steamer "Albatross" (1907-1912), the German survey vessel "Planet" (1907-1912), the German cruiser "Emden" (1927), the Danish steamer "R.S.S. Dana II" (1929), the Dutch steamer vessel "H.M.S. Villebrord Snellius" (1930), the American warship "Cape Johnson" (1945), and the Danish Navy Corvette "Galathea" (1951). However, the first applied oceanographic investigations of value for commercial fisheries were carried out from 1947 to 1950 by the Philippine Fishery Programme of the United States Fish and Wildlife Service. During this period an intensive exploration of Philippine and adjacent seas was made by the "U.S. M/V Spencer F. Baird". More than 1,100 oceanographic stations were established over an area of more than 800,000 sq. mi. The data collected are still being compiled and analyzed in the United States.

"After the termination of the Philippine Fishery Programme in 1950, the Bureau of Fisheries continued oceanographic research in the principal fishing areas, such as Manila Bay and Lingayen Gulf. The operation had to be discontinued in 1955 for a general overhaul of the research vessel "M/V David Starr Jordan". Because of lack of funds, this delay lasted until 1957.

"Although fisheries research in the Philippines, especially from 1947-54, indicates a modern approach to fishery problems through systematic scientific studies, little attention has been paid to real marine fishery biological research. Special research has only occasionally been undertaken to describe the several larval forms of marine fish, to determine the racial status, spawning and feeding habits of tuna, and the taxonomy and feeding habits of *Rastrelliger* spp. The lack of a well-balanced fisheries research programme minimized the usefulness of the oceanographic surveys in coastal areas intended to contribute to the explanation of fishery phenomena.

> "The activities of the Bureau of Fisheries in marine fisheries biological research are hardly significant compared with its other activities. Great endeavors have been made, for instance, in the fields of fresh- and brackish-water fisheries biology, aquaculture, fish processing and especially in fisheries technology. The lack of knowledge of the biology and life history of the important marine food fishes, of their behaviour, distribution and migration, etc., became more obvious in recent years when controversies arose among different groups of fishermen regarding depletion of the resources and extension of the fisheries."

From the 1970s to the Present: The Overfishing Problem

The modern theory of fishing, which development was initiated by F.I. Baranov, F.S. Russel and M. Graham before World War II, was elaborated in the late 1950s (Schaefer 1957; Beverton and Holt 1957; Ricker 1958) but it took almost one decade for it to fully take roots in its area of origin (Northern Europe and North America).

It is therefore not surprising that approaches and methodologies based on this theory, such as the detailed analysis of catch and effort data or the estimation of growth and mortality parameters of fish should not have been performed up to the end of the 1960s by any of the fishery biologists working in the Philippines, be they Filipinos or foreigners.

In the 1970s sharply declining incomes among small-scale fishers led to a number of socio-economic studies of their living conditions (Smith *et al.* 1980) and to various government-sponsored loan schemes aimed at motorization of boats and gear improvements (Small Fisherman's Loan Programme, "Biyayang Dagat", KKK Programme, etc.)

It is also in the 1970s, however, that it became clear that the available database on the Philippine fisheries was woefully inadequate, both in quantity and quality, to assess the status of the marine fisheries and of the resources.

This led, on one hand, to attempts, in cooperation with the FAO/United Nations Development Programme South China Sea Fisheries Development and Coordinating Programme in Manila, to overhaul the fishery statistical data collection system of the Philippines and, on the other hand, to attempts to estimate the fishery potential of the country using indirect methods, such as via comparative studies of maximum sustainable yield per area (Smith *et al.* 1980). Also an attempt was made to apply the "Delphi" technique to the estimation of the potential yield of the Philippine marine fisheries. As the results of this attempt have not been well disseminated, a brief account of this exercise is given in the following paragraphs.

The Delphi method, which was first developed to assess the bombing requirements of the US Air Force (Dalkey and Helmer 1951) is essentially an approach for helping experts in a certain area to reach a usable consensus on a given controversial issue in their area of expertise, given that conclusive evidence is *not* available. The main feature of the method is that it usually allows for an increasing consensus through an iterative, *anonymous* process which completely eliminates the nefarious group-dynamics effect of normal committee work (Linstone and Turoff 1975). The method has been rarely applied to fisheries (but see Zuboy 1981, for what might be the first published instance).

In late 1980, the Resource Policy and Strategy Research Program of the Ministry of Natural Resources of the Philippines sent an invitation to various fisheries experts to participate in a Delphi exercise on stock assessment, as follows:

> "The object of this exercise is to come up with approximation of the extent and potential of the country's marine fishery resources. Empirical research in this area has up to the present been minimal, making resource management decisions extremely hard to arrive at. In the absence of definite resources information, the judgement of experts in the field is now being sought so that a set of workable resources estimates that will be of practical value to the resource manager may be made available. Such resource estimate will serve two aims: (1) the management of presently exploited fisheries; and, (2) the development of highly (promising) but still unexploited fisheries".

This citation is from the material sent along with the invitation. Also included were a brief description of the Delphi method itself, miscellaneous BFAR catch statistics, a surface area estimate of the Philippine shelf and questionnaires pertaining to the first iteration of estimates, which was conducted through correspondence.

On 21-23 November 1980, a Workshop on the Assessment of the Philippine Fishery Wealth (Marine Sector): A Delphi Approach was held in Baguio, in which the final iterations were to be performed by the participating experts who came from various national and international agencies (including the author of this paper).

The meeting did not go on as planned in that near the end, the anonymity essential to the Delphi process broke down and the various experts began to argue among themselves about the validity of “their” estimates. Figure 1 and Table 2 present some of the results achieved at this stage, as polished up by staff and consultants of the Fishery Industry Development Council (FIDC) and of the Natural Resources Management Center (NRMC) shortly after the meeting itself. Time will tell whether these potential yield estimates are correct or not.

Since this meeting was conducted, a vast amount of empirical data, reports and papers have become available which may make it superfluous to resort, as far as stock assessments are concerned, to indirect approaches such as the Delphi method.

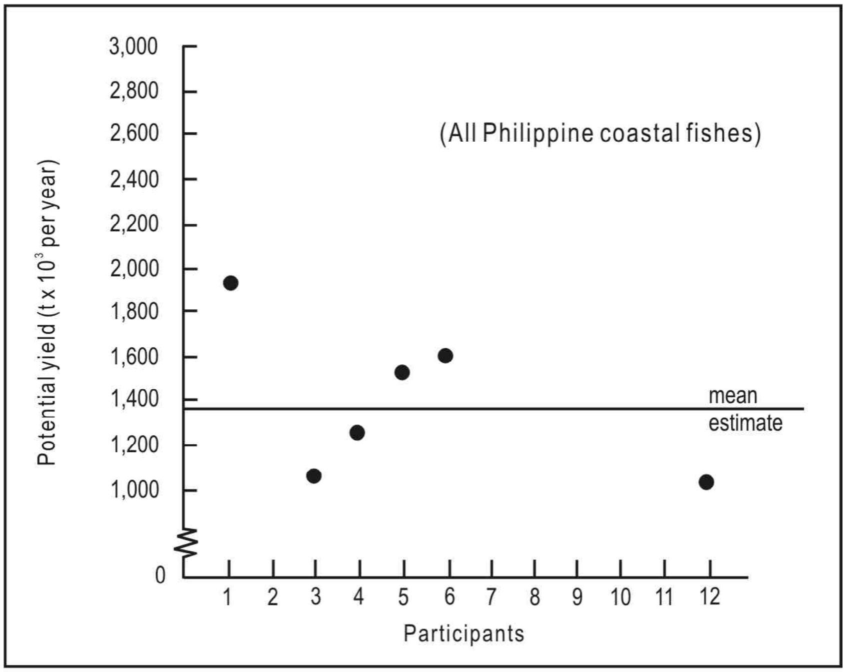
The reader compiled and introduced by Aprieto *et al.* (1986) contains, for example, a number of important contributions on the marine fisheries of the Philippines, along with an exhaustive coverage of the major bibliographic sources on the living marine resources of the country.

The compilation and the references therein show that the scientific evidence is now available on the basis of which sound management decisions can be made. Hopefully, such decisions will be made, given that the marine fisheries of the Philippines are in sore need of management.

Table 2: Estimated potential of Philippine marine waters.

Area	Species	Estimated Potential Yield (1,000 t)
Total marine area	All fish	1,650±200
A. Coastal waters	All fish	1,400±200
	Demersal	600±200
	Pelagic	800±200
Region I (Tayabas Bay, Sibuyan Sea, Visayan Sea, Samar Sea and related bays)	All fish	210±30
	Demersal	90±30
	Pelagic	120±30
Region II (Bohol Sea, East Sulu and related bays)	All fish	196±30
	Demersal	84±30
	Pelagic	112±30
Region III (Moro Sea, Davao Gulf, Southeast Mindanao Coast)	All fish	140±20
	Demersal	60±20
	Pelagic	80±20
Region IV (West Sulu Sea, Palawan, Mindoro)	All fish	462±70
	Demersal	198±70
	Pelagic	264±70
Region V (North and Northwest Luzon)	All fish	112±20
	Demersal	48±20
	Pelagic	64±30
Region VI (Pacific Coast except Southeast Mindanao)	All fish	280±40
	Demersal	120±40
	Pelagic	160±30
B. Oceanic water	Pelagic	250±50

Source: NRMC/FIDC Workshop on Assessment of Philippine Fishery Wealth (Marine Sector): A Delphi Approach.



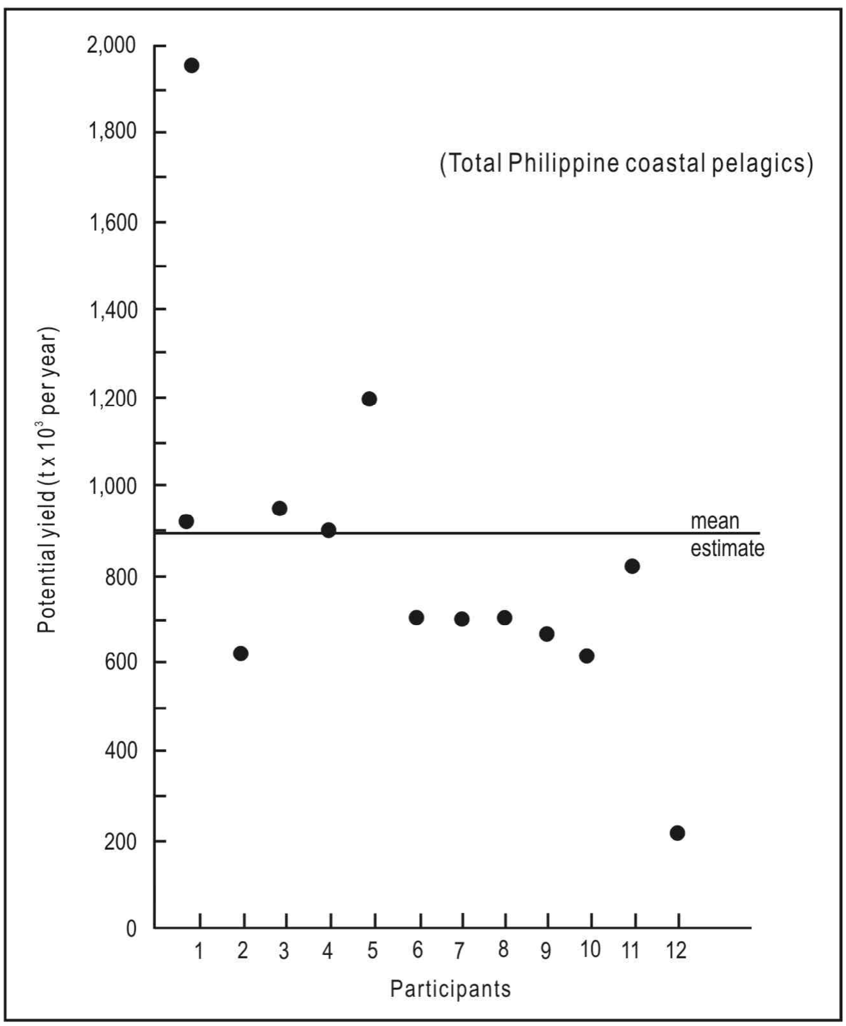


Figure 1. Examples of intermediate results obtained during the Delphi exercise to estimate potential yield of Philippine fisheries (see text). Note that in this round not all participants contributed a figure for all Philippine coastal water fishes.

Literature Cited

Anon. 1905. Censo de las Islas Filipinas. Vol. IV. Agricultura, estadistica social e industrial. US Census Office, Washington, DC, USA.

Aprieto, V., J. Saeger and D. Pauly, Editors. 1986. Selected papers on marine fisheries research (1947 to 1986). Dept. Mar. Fish. Tech. Rep. 9, xx + 436 p.

Blanco, G.J. and H.R. Montalban. 1951. A bibliography of Philippine fishes and fisheries. Philipp. J. Fish. 1(2): 115-138.

Blair, E.H. and J.A. Robertson. 1973. The Philippine Islands 1493-1898: Exploration by early navigators, descriptions of the islands and their peoples, their history and records of the Catholic mission as related in contemporaneous books and manuscripts showing the political, economic, commercial and religious conditions of those islands from their earliest relations with European nations to the beginning of the 19th century: Translated from the original/edited and annotated by E.H. Blair and J.A. Robertson: With historical introduction and additional notes by E.G. Bourne; with maps, portraits and other illustrations. Cacho Hermanos, Inc., Mandaluyong, Rizal, Philippines. 19 volumes.

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. UK Min. Agric. Fish., Fish. Invest. (Ser. 2) 19: 533 p.

Dalkey, N. and O. Helmer. 1951. The use of experts for the estimation of bombing requirements: A Delphi experiment. R-1283-PR. Rand Corporation, California,USA.

Day, F. 1875-1878. The fishes of India, being a natural history of the fishery known to inhabit the seas and fresh waters of India, Burma and Ceylon. Volumes 1 and 2. Dawson, London, UK.

Hamilton-Buchanan, F. 1822. An account of the fishes found in the River Ganges and its branches. Edinburgh and London, UK.

Herre, A.W. 1953. Checklist of Philippine fishes. US Dep. Int., Fish. Wildl. Res. Rep. 20. 977 p.

Jordan, D.S. and R.E. Richardson. 1910. A check-list of Philippine fishes. Philipp. Bur. Sci. Monogr. Publ. Fish 1: 3-78.

Lamme, W.H. 1973. Collected fish paper of Pieter Bleeker. W. Junk Publishers, The Hague, Netherlands.

Linston, H.A. and M. Turoff. 1975. The Delphi method. Addison-Wesley, Reading, Massachusetts, USA.

Ochotorena, M. 1981. Ag tobig nog keboklagan: A Subanon folk epic kinaadman. J. South. Philipp. 3: 348-543.

Pannier, F. 1982. Science in Latin America, p. 226-242. *In* C. Moraze (ed.) Science and the factors of inequality. UNESCO, Paris, France.

Ricker, W.E. 1958. Handbook of computation for biological statistics of fish populations. Bull. Fish. Res. Board Can. 119. 300 p.

Rizal, J.P. 1891. El Filibusterismo. 4, Ghent, Belgium. 286 p.

Schaefer, M.B. 1957. A study of the dynamics of the fishery for yellowfin tuna in the eastern tropical Pacific Ocean. Bull. I-ATTC/Bol. CIAT. 2: 247-268.

Smith, I.R., M.Y. Puzon and C.N. Vidal-Libunao. 1980. The Philippine municipal fisheries: A review of resources, technology and socioeconomics. ICLARM Stud. Rev. 4, 87 p.

Storer, J.A. 1967. Aspects of fisheries in the developing Philippine economy. Stud. Trop. Oceanogr. 5: 363-374.

Tiews, K. 1958. Research activities on marine fisheries biology in 1957. Philipp. J. Fish. 6(1): 71-105.

Umali, A.F. and H.E. Warfel. 1950. Guide to the classification of fishing gears in the Philippines. US Dep. Int. Fish. Wildl. Serv. Res. Rep. 17. 165 p.

Warfel, H.E. and P.R. Manacop. 1950. Otter trawl explorations in Philippine waters. US Dep. Int., Fish. Wildl. Serv. Res. Rep. 25. 49 p.

White, T. 1898. Our new possessions: a graphic account, description and historical, of the tropic islands of the sea which have fallen under our sway, their cities, people and commerce, natural resources and the opportunities they offer to Americans. Chicago, USA.

Zuboy, J. 1981. A new tool for fishery managers: The Delphi technique. N. Am. J. Fish. Manage. 1:55-59.

Overview of Philippine Marine Fisheries[1]

NOEL C. BARUT
MUDJEKEEWIS D. SANTOS
Bureau of Fisheries and Aquatic Resources
Department of Agriculture, Quezon City
Philippines

LEN R. GARCES[2]
International Center for Living Aquatic Resources Management
MCPO Box 2631, Makati City 0718
Philippines

Abstract

Marine fisheries are an important source of protein, livelihood and export earnings for the Philippines. In 1994, total marine fisheries catch was 1.67 million t (62% of total fisheries production) valued at about US$1.65 billion[3]. Of this total, 277,000 t were demersal fishes, 885,000 t small pelagics, 305,000 t tunas and 203,000 t other species or groups. Current catches have leveled off since 1991 (at a level near estimated maximum sustainable yield) and existing fishing effort is clearly too high.

This paper reviews the status of marine fisheries and the development of trawl fisheries in the Philippines. The combined effects of excessive fishing effort and environmental degradation have contributed to the depletion of fishery resources, particularly coastal demersal and small pelagic fishes.

Introduction

Fisheries are an important component of the agricultural sector in the Philippines. In 1994, they accounted for 4.3% of gross domestic product and 18% (US$2.5 billion) of gross value added by the agriculture, fishery and forestry sectors. Fisheries provide livelihood to about 1 million individuals or about 5% of the country's labor force. Fishery exports were about 172,000 t in 1994 valued at US$578 million. Fish consumption in the Philippines is high at about 28.5 kg / capita / year.

Marine fisheries landings in 1994 were about 1.67 million t valued at about US$1.65 billion. This represented roughly 62% of the total fisheries production in the country; the rest was contributed by the aquaculture and inland fisheries sectors. The municipal (i.e., small-scale) fisheries sector contributed 47% (787 000 t) of marine fisheries catches, while the balance (885 000 t) came from the commercial fisheries sector.

The increased demand for fish from a rapidly growing population and increasing exports has substantially increased fishing pressure on the marine fishery resources in the past two decades. In February 1996 the National Fisheries Workshop on Policy Planning and Industry Development pointed to resources depletion and environmental degradation as the key issues facing the fisheries sector. Declining catch rates in many traditional fishing grounds and the leveling off of marine landings since 1991 support these conclusions. The sections below provide an overview of the status of Philippine marine fisheries.

---

[1] This paper is a reprint of the full article which originally appeared as: BARUT, N.C., M.D. SANTOS and L.R. GARCES. 1997. Overview of Philippine marine fisheries, p. 62-71. *In* G. Silvestre and D. Pauly (eds.) Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p. (ICLARM Contribution No. 1390).

This paper can be cited as above or as follows: BARUT, N.C., M.D. SANTOS and L.R. GARCES. 2004. Overview of Philippine marine fisheries, p. 22-31. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] Current address is: The World Fish Center, Jalan Batu Maung, Batu Maung, 11960 Bayan Lepas, Penang, Malaysia.

[3] In 1994: $1 = P23.75.

Marine Environment and Activities

The Philippines is an archipelago consisting of more than 7,100 islands. It extends about 2,000 km in a south-north direction, between 4°05' and 21°30' N latitude, from the northeast coast of Borneo to 150 km off Taiwan (Figure 1). The total territorial water area, including the exclusive economic zone (EEZ), is about 2.2 million km^2. The shelf area, down to 200 m covers 184,600 km^2.

Pioneering expeditions that contributed significantly to information on Philippine hydrography were those of the *Nuestra Señora de Buena Esperanza* (1587), *Desire* (1588), *Cygnet* (1688), *Elizabeth* (1762), *Atrevida* and *Descibierta* (1792), *Santa Lucia* and *Magallanes* (1800), *Rhone* (1819), *Samarang* (1843), *Royalist* (1850-1854), *Riffleman* and *Nassau* (1868-1869) (Sebastian 1951). Oceanographic data were also made available through similar explorations during the late 19th to the mid-20th centuries. The Danish *Galathea* collected oceanographic information in Manila Bay, Dinagat and Surigao between 1845 and 1847. In 1875, the British *H.M.S. Challenger* Deep Sea Expedition conducted investigations in the Sulu Sea and the Visayas. From 1907 to 1909, the marine life of the islands was surveyed extensively by the *Albatross* Philippine

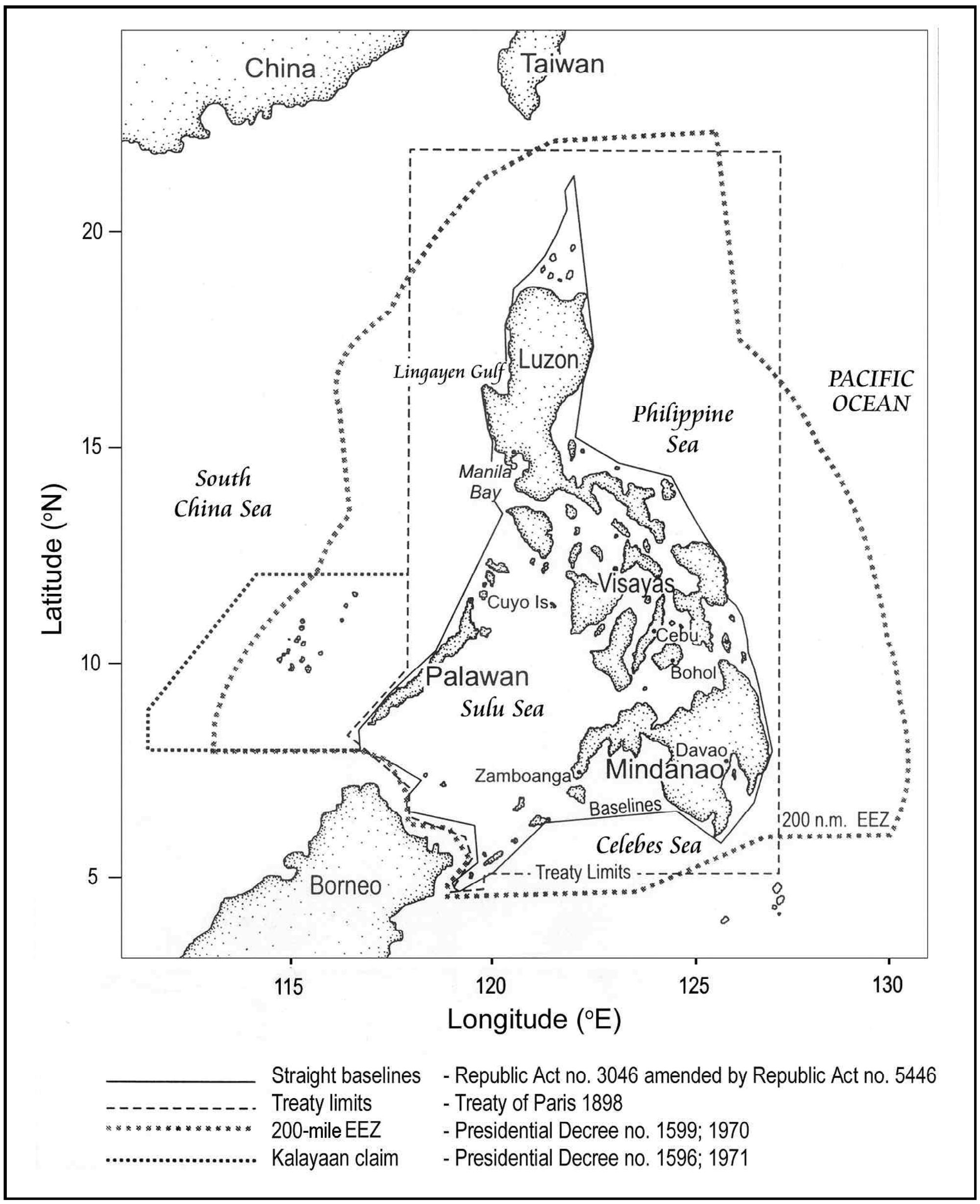


Figure 1. Marine jurisdictional boundaries of the Republic of the Philippines.

expedition which was sponsored by the US Bureau of Fisheries. Other explorations that followed were the German survey vessel *Planet* (1907-1912), the German cruiser *Emden* (1927), the Danish research vessel *R.S.S. Dana II* (1929), the Dutch research vessel *H.M.S. Willebrord Snellius (1903)*, the Japanese *Manshu*, *Yamato*, and *Musashi* (1934-1942) and the US naval vessel *Cape Johnson* (1945). In 1947-1950, the *S.F. Baird*, under the Philippine Fishery Program of the US Fish and Wildlife Service, conducted an extensive investigation of the Celebes Sea, Sulu Sea, South China Sea and the waters of the Philippine Sea covering an area of more than 2,074,500 km^2. In 1951-1952, the *Galathea* made an intensive biological survey of the Philippine Deep.

The waters east of the Philippines are affected by the major large-scale ocean currents of the Pacific. The major current system affecting the Philippines is the North Equatorial Current which flows westward across the Pacific, hits the eastern coast of the country and splits into northward and southward branches. The northward branch flows along the east coast of the Visayas and Luzon, moving to Taiwan and Japan as the Kuroshio Current. The southward branch becomes the Mindanao current, moving southward along the east coast of Mindanao. The influence of the strong seasonally reversing monsoon winds on water circulation is more pronounced on the western side of the Philippines. During the northeast monsoon a cyclonic pattern of surface water movement develops in the South China Sea with a northwesterly flow along the western coasts of Palawan and Luzon. During the southwest monsoon water movement in the South China Sea is generally northeasterly, flowing out through the straits between Luzon and Taiwan (Wyrtki 1961; Soegiarto 1985). The work of Wyrtki (1961) described the water masses in the area. Historical hydrographic data indicated that Philippine waters are very similar to those of the western Pacific.

The country's marine environment is distinctly tropical in character, with relatively warm and less saline waters. Sea surface temperatures are generally above 28^{o}C in summer and only a few degrees lower during the cold months. Salinity variations are very small, especially in the eastern parts of the country. These variations increase during the moisture-laden southwest monsoon in the western parts of the country. The waters are typically poor in nutrients, with small upwellings, gyres and mixing processes occasionally enhancing local productivity. Nutrient depletion can extend to depths of 50-100 m in open waters. The thermocline depth is usually about 150 m and varies seasonally. Nutrient concentrations and biological productivity are highest over the shelves, declining rapidly with depth and distance from the coast.

Water quality studies in the country are limited to highly localized and pollution-prone areas. Evident in all these studies is the deterioration of water quality brought about by mine tailings, agricultural runoffs, siltation, domestic sewage and oil spills. Almost all results indicate abiotic and biotic parameters (e.g., pH, salinity, turbidity, dissolved oxygen, heavy metal content, coliform count) exceeding standards set by the Environmental Management Bureau of the Department of Environment and Natural Resources.

Coral reefs abound in shallow water areas not subjected to low salinity from freshwater inflows, sedimentation and physical perturbations, with about 27,000 km^2 of coral reef area within the 30 m depth contour. There are more than 70 genera and 400 species of hard corals documented, as well as about a thousand associated fish species (Gomez *et al.* 1994). Reef areas contribute substantially to fisheries productivity, with fish yields ranging from 5 to 37 $t \cdot km^{-2}$ (Alcala and Gomez 1985). Extensive coralline or hard bottoms are found around Palawan, Sulu, the Visayas and the central part of the country's Pacific coast. A large portion of Philippine coral reefs has been subjected to serious degradation which reduced their productivity (Yap and Gomez 1985). Major destructive factors are sedimentation and siltation from coastal development and activities, illegal and destructive methods of fishing and overfishing (Gomez *et al.* 1994). Coral cover data from various surveys of Philippine reefs indicate that 5% are in excellent condition (more than 75% living coral cover), 25% in good condition (50-75% living coral cover) and the rest in fair and poor condition (below 50% living coral cover) (Gomez 1991).

Mangrove communities are integral and important components of the coastal ecosystem. These are categorized into mangrove swamps composed mainly of large trees and associates, and *nipa* swamps which are characterized by stemless palm growths. Forty-one species of mangroves have been identified in the Philippines. These yield by-products such as timber and other building materials, high-grade charcoal, tannins, resins, dyes and medicines. Mangrove areas are under pressure for conversion to other uses, notably aquaculture and human settlement. In 1965, mangrove areas covered about 4,500 km^2. Ten years later, only about 2,500 km^2 were left. Sixty percent of this decline was due to conversion into aquaculture ponds for milkfish and prawns (Primavera 1991). By 1981 an aggregate cover of only 1,460 km^2 was intact. This prompted government and nongovernment agencies to suspend permits for mangrove conversion to fishponds, accelerate reforestation activities and spur community-based management.

Seagrass communities regulate water flow and wave energy together with coral reefs and mangroves. There are 16 seagrass species recorded in the Philippines, second only to Western Australia among the 27 countries of the Indo-Pacific region. Extensive seagrass beds have been identified in Bolinao, Palawan, Cuyo Island, Cebu, Bohol, Siquijor, Zamboanga and Davao. Seagrass communities in the country manifest signs of degradation due to the combined effects of natural calamities, predation, aquaculture, deforestation, siltation and destructive fishing methods (Fortes 1990).

Seaweed beds, like coral reef, mangrove and seagrass communities, play a vital role in the coastal environment. They provide feeding and nursery grounds for different types of marine macro and microorganisms and interact with seagrasses to control ocean wave action. Aside from its ecological function this group of marine macrobentic algae is also an important human food source. There are 190 species of seaweed recorded in the Philippines. About 150 species are considered economically important but only a few are cultivated (particularly *Eucheuma* spp.). Other species under the genus *Sargassum* and *Gracilaria* are harvested from natural beds. To date, the Philippines is the world's leading supplier of *Eucheuma*, producing about 80% of total world supply. There are about 80,000 seaweed farmers with 350,000 dependents that rely on the seaweed industry in the country (Dakay 1992).

Marine Capture Fisheries

Philippine marine fisheries are conventionally subdivided into municipal (small-scale) and commercial fisheries on the basis of vessel gross tonnage. Municipal fisheries include capture operations using boats less than 3 GT and those that do not involve the use of watercraft. A license is issued by the municipality where the boat is registered, hence the name. Fishing permits are issued to fishing boats by the municipality where they intend to fish. Commercial fisheries include capture fishing operations using vessels of 3 GT and above. Commercial fishing vessels are required to secure a commercial fishing boat license from the Bureau of Fisheries and Aquatic Resources (BFAR) before they can operate. Until recently commercial fishing vessels were only allowed to operate in waters beyond 7 km from the shoreline. With the implementation of the Local Government Code in 1992, coastal waters within 15 km from the shoreline are now considered municipal waters and commercial fishing is not allowed within this area.

Figure 2 illustrates the total marine, commercial and municipal fisheries catches in the Philippines from 1950 to 1994. Total marine landings showed accelerated growth during the periods 1962-1975 and 1985-1991, but leveled off to around 1.65 million t in the early 1990s. This was brought about by the decline in municipal fisheries landings being compensated by the commercial fisheries sector, which may be

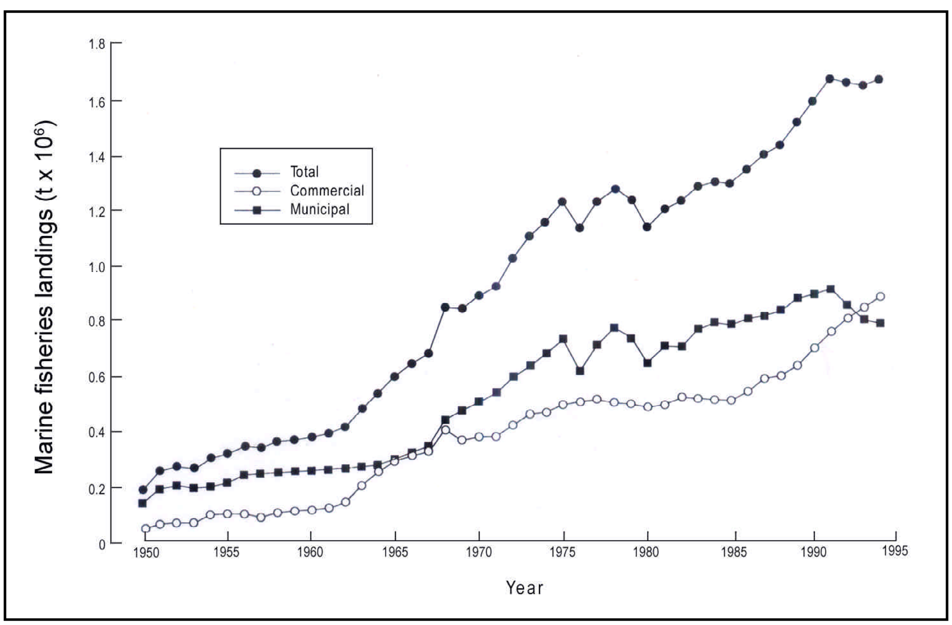


Figure 2. Philippine marine fisheries production by sector from 1950 to 1994 (BFAR and BAS statistics, 1994).

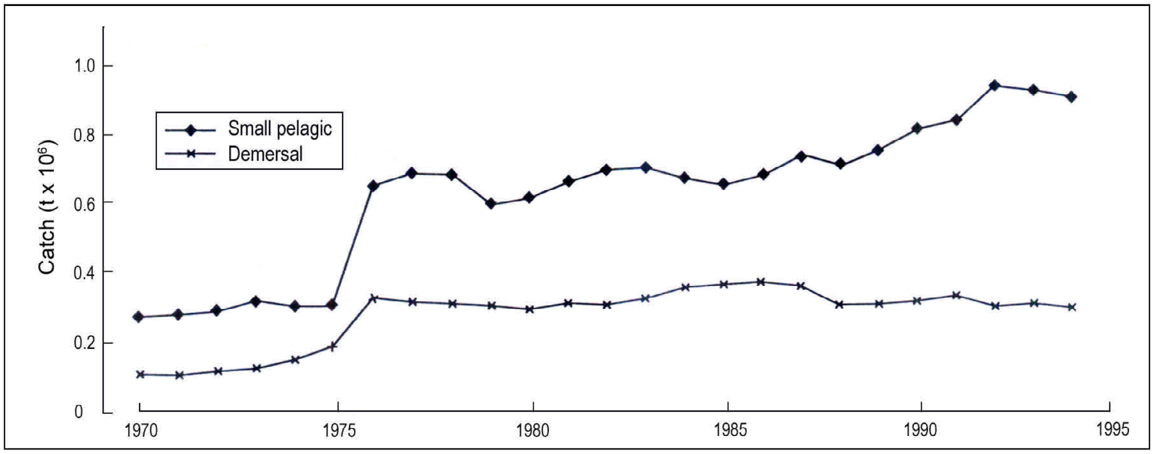


Figure 3. Demersal and small pelagic fisheries in the Philippines from 1970 to 1994 (BFAR and BAS statistics).

indicative of increasing resource depletion and competition in nearshore fishing grounds.

In 1994, the marine landings of 1.67 million t consisted of 17% (277,000 t) demersal fishes, 53% (885,000 t) small pelagics, 18% (305,000 t) tunas and 12% (203,000 t) miscellaneous species or groups. Figure 3 illustrates the trend in demersal and small pelagic fish production in the Philippines from 1970 to 1994. Note that the catch of demersals has leveled off since 1976. The catch of small pelagics, on the other hand, was almost the same from 1976 to 1988, increased rapidly from 1988 to 1992, then declined from 1992 to 1994. These catch trends in the face of continuously increasing fishing effort reflect assessments indicating overfishing of demersal and small pelagic fish stocks.

The trawl is commonly used by the commercial sector to exploit demersals while gillnets, hook and lines and "baby" trawls are most commonly used by municipal fishers in catching demersal species or groups. Silvestre *et al.* (1986) provide a detailed review of trawl and demersal fisheries development in the Philippines and the consequent decline of demersal biomass in the country's coastal waters. Numerous trawl surveys have been conducted in Philippine waters (see Appendix III) which document this decline and which potentially offer numerous insights for improved fisheries management if standardized and analyzed more exhaustively.

The commercial sector commonly uses bagnets, purse seines and ringnets for catching small pelagics while municipal fishers dominantly use gillnets, beach seines and round haul seines. Roundscads, sardines, anchovies, mackerels, big-eye scads, round herrings and fusiliers dominate small pelagic catches in the Philippines.

Six species of tuna dominate Philippine landings, i.e., yellowfin tuna (*Thunnus albacares*), big-eye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*), eastern little tuna (*Euthynnus affinis*), frigate tuna (*Auxis thazard*) and bullet tuna (*Auxis rochei*). The most common gear used by the commercial sector in catching tuna are purse seines and ringnets, while municipal fishers mainly use handlines. All these gears are operated jointly with fish aggregating devices known as *payao*. Tuna production increased from about 9 300 t in 1970 to 125 000 t in 1976 with the introduction of *payao* in 1975. Wider use of *payao* has contributed to the high level of tuna catches in the country.

The available information on fishing effort is limited. Table 1 gives a summary of the number of commercial fishing vessels in the Philippines, by gear type, and gross tonnage from 1967 to 1987. Note that the trawl, bagnet and purse seine were the most widely used gear during this period; also a shift to larger vessels (i.e., from 3-5 GT to 10-<50 GT) is evident. Similar vessel information prior to 1967 is unavailable, while information after 1987 is difficult to extract due to changes in methods of fishery statistics collection resulting from the transfer of such functions from BFAR to the Bureau of Agricultural Statistics (BAS). Information pertaining to municipal fisheries is far more limited, although periodic information may be available from national censuses occasionally conducted in the past (Dalzell *et al.* 1987).

The potential yield from the marine fishery resources of the Philippines has been studied extensively (Munro 1986; Silvestre *et al.* 1986; Dalzell and Ganaden 1987). Estimates of maximum sustainable yield (MSY) from conventional fishery resources vary widely between 1.1 and 3.7 million t. The higher estimates are based on overly optimistic yield-per-unit area figures and do not consider productivity decline with depth. The scientific consensus since the 1980s is that MSY from conventional resources is

Table 1. Total number of commercial fishing vessels in the Philippines by gear type and tonnage from 1967 to 1987 (BFAR statistics). See text.

Category	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Total number of vessels	2,361	2,225	2,273	2,284	2,180	2,222	2,513	2,286	2,543	2,571	2,269	2,133	2,464	2,407	2,349	2,580	2,634	2,666	2,484	2,283	2,516
Total gross tonnage	81,268	81,950	84,117	89,688	90,550	99,554	113,325	103,325	101,209	103,219	103,078	70,012	91,999	77,346	99,471	105,122	103,297	97,672	90,453	83,506	87,309
Powered vessels	2,124	2,033	2,040	2,061	2,142	2,169	2,455	2,202	2,488	2,525	2,218	2,123	2,421	2,366	2,310	2,473	2,514	2,621	2,343	2,168	2,331
Nonpowered vessels	225	174	182	179	311	53	54	82	55	46	51	10	43	41	39	107	120	45	141	17	16
Number by gear																					
Bagnet	1,002	883	796	858	743	650	791	584	713	656	504	642	641	624	552	603	578	652	602	565	618
Beach seine	45	44	41	49	35	44	41	51	77	75	103	46	63	77	58	59	59	55	70	60	37
Gillnet	7	5	15	15	15	12	29	27	23	23	19	16	18	23	6	9	3	7	5	2	3
Hook and line (handline)	111	88	97	88	83	94	81	76	63	73	67	50	57	97	109	61	93	120	104	91	77
Longline	9	14	9	9	5	10	3	5	5	5	8	5	22	26	70	61	62	62	55	41	62
Drive-in-net (muro-ami)	37	25	24	26	37	39	67	37	35	36	34	5	41	7	45	39	43	37	37	34	29
Purse seine (ringnet)	197	202	253	245	265	320	470	280	313	342	280	328	408	412	450	516	404	318	306	280	296
Pushnet	-	-	-	-	2	7	1	33	55	72	62	92	90	57	47	78	105	92	668	54	50
Otter trawl	593	653	667	653	652	690	794	767	763	786	684	769	877	848	739	829	932	884	763	702	769
Round haul seine	108	85	69	76	61	53	50	38	27	20	31	23	38	33	26	34	45	37	46	25	28
Others	240	208	251	221	275	303	212	388	469	483	477	157	143	158	247	291	315	402	448	428	547
Not reported	12	18	51	44	7	-	4	2	-	-	-	-	66	45	-	-	84	-	-		
Number by tonnage																					
3 to less than 5	832	711	677	666	664	261	268	205	285	246	234	214	219	205	165	144	149	186	103	93	94
5 to less than 10	-	-	-	-	-	358	426	450	571	627	587	575	611	606	533	584	618	674	539	477	494
10 to less than 20	534	476	469	478	443	466	529	480	559	532	432	515	583	653	636	730	672	686	659	633	715
20 to less than 50	411	421	414	426	422	444	534	468	497	531	470	421	503	467	483	508	567	611	602	562	629
50 to less than 100	416	437	480	478	440	458	495	427	395	397	328	291	311	278	277	275	277	265	251	232	230
100 to less than 200	-	-	-	-	-	195	203	195	178	179	154	86	141	137	145	156	158	138	136	118	119
200 to less than 500	-	-	-	-	-	40	58	61	58	59	62	13	47	17	54	55	57	48	43	47	44
500 and over	156	162	182	192	211	-	-	-	-	-	2	4	6	3	20	21	16	13	10	96	6
Not reported	12	18	51	44	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	98	169

1.650±0.250 million t, i.e., 600±100 thousand t of demersals, 800±100 thousand t of coastal pelagics and 250±50 000 t of tunas or oceanic pelagics (BFAR 1995).

Figure 4 illustrates the results of the assessment of demersal fisheries. The figure indicates the following: MSY for exploited demersal resources (i.e., excluding offshore hard bottoms around Palawan, southern Sulu Sea area, and the central part of the country's Pacific coast) is about 340,000-390,000 t, while the maximum economic yield (MEY) ranges from 280,000 to 300,000 t worth of fish and invertebrates. Subsequent refinements of this assessment yielded similar results (Silvestre and Pauly 1987). Note that the MSY of 340,000-390,000 t, when combined with the MSY estimates for unexploited or lightly fished hard bottom areas of 200,000 t, come very close to the consensus demersal MSY of 600±100,000 t noted above.

Assessment of the exploitation status of currently fished demersal stocks indicates that these resources are biologically and economically overfished. Studies indicate that the biomass of currently fished stocks has declined to about 30% of its original levels in the late 1940s (Silvestre *et al.* 1986). It can also be noted in Figure 4 that fishing effort could be reduced by three-fifths without substantially reducing demersal yields. The annual rent dissipation from overfishing of the demersal stocks is about US$130 million per year. Reduction of fishing effort and reallocation of those displaced to lightly fished, hard-bottom areas is required.

Figure 4 also illustrates the results of the assessment of small pelagic fisheries. The data indicate the following: MSY for small pelagics of about 550,000 t; MEY of 250,000 t for fish and invertebrates in the

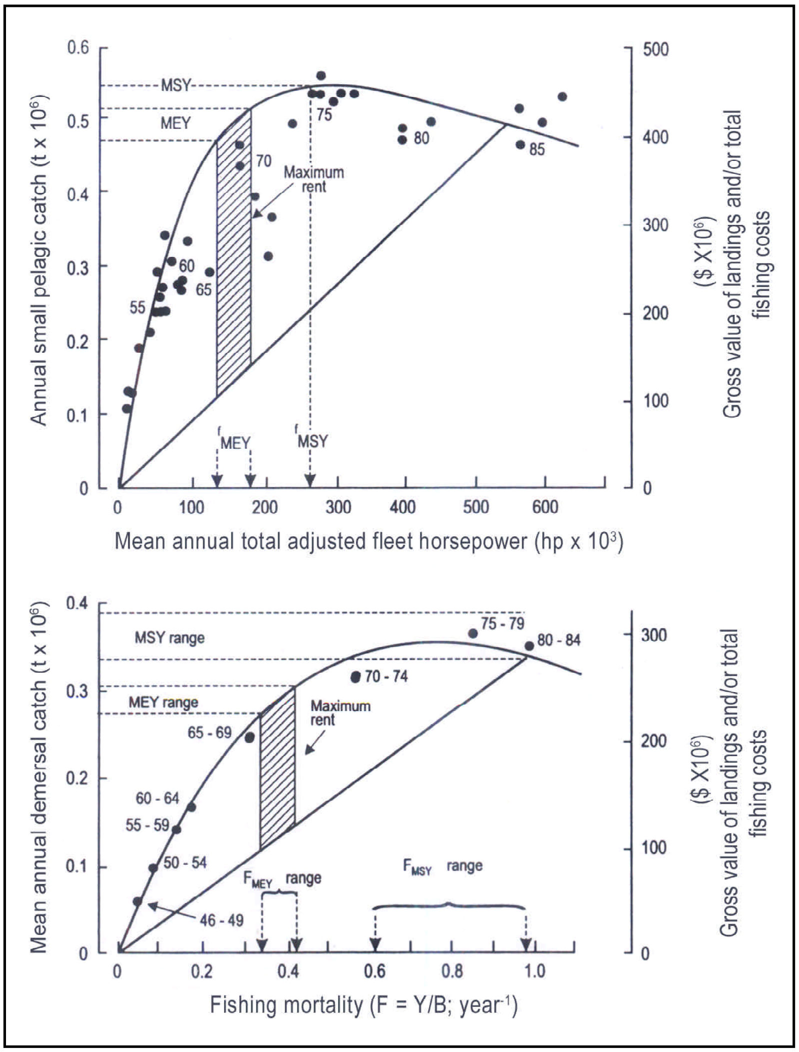


Figure 4. Surplus production model of demersal and small pelagic fisheries in the Philippines providing estimates of MSY and economic rent for exploited areas/ resources (Silvestre and Pauly 1986; Dalzell *et al.* 1987).

exploited fishing grounds; and a maximum economic rent (MER) of $290 million worth of fish and invertebrates (Dalzell *et al.* 1987). Subsequent refinements of this assessment have yielded similar results (Trinidad *et al.* 1993). The MSY figure of 550,000 t, when combined with MSY estimates of 250,000t for lightly fished small pelagic resources or fishing grounds (i.e., in waters off Palawan, parts of the country's Pacific coasts and some parts of Mindanao), virtually equals the consensus small pelagic MSY of 800±100,000 t noted above. Thus, available information also indicates that the small pelagics are biologically and economically overfished. The consequent rent dissipation is about $290 million annually. Fishing effort is particularly high in nearshore coastal areas, especially the traditional fishing grounds. Effort level in the mid-1980s was already more than twice the level necessary to harvest MSY (Figure 4). The obvious need for small pelagic fisheries is to reduce effort and reallocate the excess to lightly fished areas. There are indications that this expansion has occurred since the work of Dalzell *et al.* (1987).

The assessment of tuna indicates that the fishing pressure on the stocks in Philippine waters is high (Dalzell and Corpuz 1990; BFAR 1995). The magnitude of the catches and the concentration of fishing effort within a small surface area indicate a very high local fishing mortality. There is a need to expand to other fishing areas (further offshore) off the South China Sea and the Pacific coast of the country. Such a move may increase the size of tuna catches in Philippine waters, which largely do not meet export market requirements. Commercial fishing operations are known to have expanded to Indonesia, Micronesia and Papua New Guinea through joint venture arrangements from private sector initiatives.

The oceanic large pelagics such as marlin, swordfish and sailfish are not fully exploited at present. From a landing of 17,000-25,000 t in the late 1980s, the large pelagic landings have declined to 9,000-15,000t in the 1990s.

Nonconventional resources such as oceanic squid and deep-sea shrimp occur in Philippine waters. At present there is no established fishery for these resources and there is very little information to assess resource potential.

Management Issues and Opportunities

An excessive fishing effort level is evident from the various countrywide and site-specific fisheries assessments conducted in the Philippines. Species composition changes reflective of growth, recruitment and ecosystem overfishing have occurred in many areas (Silvestre *et al.* 1986; Pauly *et al.* 1989; Cinco *et al.* 1994). Economic overfishing is also quite evident. There is a need to improve fisheries management, in general, and to effect effort reduction, in particular. It should be noted, moreover, that distributional inequity and conflict between municipal and commercial fisheries is an issue in many areas, particularly in nearshore, traditional fishing grounds. For instance, in the San Miguel Bay fisheries in the early 1980s, 50% of pure profits went to 95 trawlers owned by 35 households, and the rest went to 2,288 municipal gear units owned by 2,030 households (Smith *et al.* 1983). Thus, effort reduction should be sensitive to considerations of distributional equity.

The decline of fishery resources in the Philippines, particularly of demersals and small pelagics, is presumably a combined effect of excessive fishing effort and coastal environmental degradation. The quantitative link of resource decline to habitat degradation, however, is difficult to document. Habitat degradation is more complex and serious in highly populated coastal areas. Habitat degradation due to pollution is mostly site-specific. Table 2 illustrates a typical coastal transect, indicating activities and issues which require attention for effective coastal fisheries management in the Philippines. These issues, taken within the larger framework of integrated coastal zone management (ICZM), require increased attention and support in the Philippines. ICZM schemes have been implemented in 12 selected coastal areas in the country under the ADB-funded Philippine Fisheries Sector Program (1991-1997). Participatory schemes that develop the knowledge and capability of stakeholders and local governments (consistent with the 1992 Local Government Code) to manage their resources have been initiated successfully, requiring wider replication and continued support.

Improvement of information inputs into the fisheries management decisionmaking process requires immediate action in the Philippines. The statistical gaps resulting from the transfer of fisheries statistics collection from BFAR to BAS after 1987 need urgent attention. In this context, we note the availability of numerous trawl surveys conducted in the Philippines (Appendix III). The work of Silvestre *et al.* (1986) and Silvestre and Pauly (1987) illustrate some of the insights which can be derived from these underutilized data. Retrospective analyses of these surveys using recently developed techniques such as population, community analysis (McManus 1986, 1989) and ecosystem analysis (Christensen and Pauly 1993, 1996) and along the lines suggested in Pauly and Martosubroto (1996) can provide numerous insights which can improve fisheries management in the Philippines. The availability of

Table 2. Coastal transect indicating activities and issues relevant to integrated coastal zone and coastal fisheries management in the Philippines.

	Terrestrial			Coastal		Marine	
Major zones	**Upland (>18% slope)**	**Midland (8-18% slope)**	**Lowland (0-<8% slope)**	**Intertidal (1 km inland from HHWL-30 m depth)**	**Nearshore (30 m-200 m depth)**	**Offshore (>200 m depth-EEZ)**	**Deepsea (Beyond EEZ)**
Main resource uses/activities	Logging Mining Upland agriculture	Logging Farming Mining Dams Livestock production	Agriculture Urban development Industrial development Tourism Human settlement Freshwater fisheries Freshwater aquaculture	Aquaculture Municipal fisheries Mangrove forestry Tourism Ports/marine transport Human settlements Salt production Sand/gravel mining	Municipal fisheries Commercial fisheries Marine transport	Commercial fisheries Marine transport	Fisheries Marine transport
Main environmental issues/impacts on the coastal zone	Siltation/ sedimentation Flooding Heavy metal pollution Agrochemical loading	Siltation Agrochemical loading Flooding Increased salinity Organic loading	Agrochemical loading Sewage disposal Industrial wastes Solid wastes Siltation Overfishing	Agrochemical loading Overfishing Mangrove depletion Coral reef degradation Oil spills Sewage disposal Habitat conversion Organic loading Siltation Red tides Reduced biodiversity	Overfishing Solid wastes Oil spills	Overfishing Oil spills Poaching	Oil spills Overfishing

sound, scientific information will facilitate the elevation of resource allocation decisions into objective rather than emotional debates.

Acknowledgements

We wish to thank the staff of the Pelagic Resources Section, BFAR, particularly Ana Marie Coronel, Criselda Malit, Jenneth Manzano, Clarita Ulanday and Val Manlulu for their assistance in locating, preparing and encoding statistical information used in this paper. Thanks are also due to Salud Ganaden, Luz Regis and Leony Mijares for their assistance and suggestions in the preparation of the paper, and Geronimo Silvestre of ICLARM for his technical guidance.

References

Alcala, A.C. and E.D. Gomez. 1985. Fish yields of coral reefs in Central Philippines. Proc. 5th Int. Coral Reef Symp. 5: 521-524.

BFAR (Bureau of Fisheries and Aquatic Resources). 1950-1987. Fisheries statistics of the Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1995. On the allocation of fishing area for exclusive use by the municipal fisheries sector: a policy brief. BFAR, Quezon City, Philippines.

Christensen, V. and D. Pauly, Editors. 1993. Trophic models of aquatic ecosystems. ICLARM Conf. Proc. 26, 390 p.

Christensen, V. and D. Pauly. 1996. Ecological modeling for all. Naga, ICLARM Q. 19(2): 25-26.

Cinco, E.A., J.C. Diaz, R. Gatchalian and G.T. Silvestre. 1994. Results of the San Miguel Bay trawl survey. *In* G. Slivestre, C. Luna and J. Padilla (eds.) Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1991-1993). ICLARM Tech. Rep. 47 (CD-ROM).

Dakay, B.U. 1992. The state of the seaweed industry in the Philippines, p. 23-27. *In* C. Calumpong and E. Mines (eds.) Proceedings of the Second Philippine-U.S. Phycology Symposium/Workshop, 6-10 January 1992. Silliman University Press, Dumaguete City, Philippines. 376 p.

Dalzell, P. and P. Corpuz. 1990. The present status of small pelagic fisheries in the Philippines, p. 25-51. *In* C.R. Pagdilao and C.D. Garcia (eds.) Philippine tuna and small pelagic fisheries: status and prospects for development. Proceedings of the Seminar-Workshop, 27-29 July 1988. Zamboanga State College of Marine Science and Technology, Zamboanga City, Philippines. Philippine Council for Aquatic and Marine Research and Development Book Ser. No. 7.

Dalzell, P. and R.A. Ganaden. 1987. A review of the fisheries for small pelagic fishes in Philippine waters. BFAR Tech. Pap. Ser. 10(1), 58 p. ICLARM, Manila, Philippines and Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Dalzell, P., P.Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. BFAR Tech. Pap. Ser. 10(3): 23 p.

Fortes, M.D. 1990. Seagrasses: A resource unknown in the ASEAN region. ICLARM Educ. Ser. 5, 46 p.

Gomez, E.D., P.M. Aliño, H.T. Yap and W.Y. Licuanan. 1994. A review of the status of Philippine reefs. Mar. Pollut. Bull. 29(1-3): 62-68.

McManus, J.W. 1986. Depth zonation in a demersal fishery in the Samar Sea, Philippines, p. 483-486. *In* J. Maclean, L. Dizon and L. Hosillos (eds.) The First Asian Fisheries Forum. Asian Fisheries Society, Manila.

McManus, J.W. 1989. Zonation among demersal fishes of Southeast Asia: the southwest shelf of Indonesia, p. 1011-1022. *In* O. Magoon, H. Converse, D. Miner, L. Thomas Tobin and D. Clark (eds.) Coastal Zone '89. Proceedings of the Sixth Symposium on Coastal and Ocean Management. American Society of Civil Engineers, New York, USA.

Munro, J.L. 1986. Marine fishery resources in the Philippines: catches and potential, p. 19-45. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources management and socio-economics of Philippine marine fisheries. Dep. Mar. Fish. Tech. Rep. 10, 217 p.

Pauly, D., G.T. Silvestre and I.R. Smith. 1989. On development, fisheries and dynamite: a brief review of tropical fisheries management. Nat. Resour. Modelling 3(3): 307-329.

Pauly, D. and P. Martosubroto, Editors. 1996. Baseline studies of biodiversity: the fish resources of Western Indonesia. ICLARM Stud. Rev. 23, 312 p.

Primavera, J.H. 1991. Intensive prawn farming in the Philippines: ecological, social and economic implications. Ambio 20: 28-31.

Sebastian, A.R. 1951. Oceanographic research in the Philippines. Philipp. J. Fish. (1): 147-153.

Silvestre, G. and D. Pauly. 1986. Estimate of yield and economic rent from Philippine demersal stocks 1946-1984. Paper presented at the IOC/WESTPAC Symposium on Marine Science in the Western Pacific: The Indo-Pacific Convergence, 1-6 December 1986, Townsville, Australia.

Silvestre, G.T., R.B. Regalado and D. Pauly. 1986. Status of Philippine demersal stocks-inferences from underutilized catch rate data, p. 47-96. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socioeconomics of Philippine marine fisheries. Dep. Mar. Fish. Tech. Rep. 10, 217 p.

Silvestre, G.T. and D. Pauly. 1987. Estimate of yield and economic rent from Philippine demersal stocks (1946-1984) using vessel horsepower as an index of fishing effort. Univ. Philipp. Visayas Fish. J. 3(1-2): 11-24.

Smith, I.R., D. Pauly and A.N. Mines. 1983. Small-scale fisheries of San Miguel Bay, Philippines: Options for management and research. ICLARM Tech. Rep. 11, 80 p.

Soegiarto, A. 1985. Oceanographic assessment of East Asian Seas. *In* Environment and resources of the Pacific, p. 173-184. UNEP Reg. Seas Rep. Stud. 69: 244 p.

Trinidad, A.C., R.S. Pomeroy, P.V. Corpuz and M. Agüero. 1993. Bioeconomics of the Philippine small pelagic fishery. ICLARM Tech. Rep. 38, 74 p.

Wyrtki, K. 1961. Physical oceanography of the southeast Asian waters: scientific results of marine investigations of the South China Sea and Gulf of Thailand 1951-1961. Naga Rep. Vol. 2. Neyenesch Printers, California. 195 p.

Yap, H.T. and E.D. Gomez. 1985. Coral reef degradation and pollution in the East Asian Seas, p. 185-207. UNEP Reg. Seas Rep. Stud. 69: 244 p.

Overview of the Small Pelagic Fisheries[1]

ESTER C. ZARAGOZA
CESARIO R. PAGDILAO
ERIBERTO P. MORENO
Philippine Council for Aquatic and Marine Research and Development
Department of Science and Technology
Los Baños, Laguna
Philippines

Introduction

In the Philippines, small pelagic fishes as a group consist predominantly of roundscads (*Decapterus* spp., Carangidae), anchovies (*Stolephorus* spp., Engraulidae), sardines (*Sardinella* spp., Clupeidae) and mackerels (*Rastrelliger* spp., Scombridae). Also included in this group are the round herrings (Clupeidae), fusiliers (Caesionidae), bigeye scads (Carangidae), flying fishes (Exocoetidae) and halfbeaks (Hemiramphidae). Small pelagic fishes are usually found in continental shelf waters (not exceeding 200 m depth). They generally attain maximum weights not exceeding 500 g, and have fast growth rates and short life spans. Most small pelagics exhibit schooling behavior and are planktivores, although some are piscivores in their later life stages. The abundance of small pelagic fishes is highly seasonal, and is affected by the seasonal productivity cycle in coastal waters influenced by monsoon winds, rainfall and plankton biomass.

The fisheries on small pelagic fishes comprise an important segment of the country's fisheries industry. In 2001, the small pelagic fisheries production was about 1.1 million t or roughly 35% of the total fisheries production. Small pelagic fisheries are considered the main source of inexpensive animal protein for lower income groups in the Philippines. These groups constitute about 70% of the population and spend over 65% of their income on food. Thus, fisheries management is very important for the country's food security.

Countrywide assessments of small pelagic fisheries of the Philippines are given, among others, in the works of Munro (1986); Calvelo and Dalzell (1987); Dalzell and Ganaden (1987); Dalzell *et al.* (1987); Dalzell and Corpuz (1990); Pagdilao *et al.* (1993); and Trinidad *et al.* (1993). More recent site-specific assessments of small pelagic fishes and fisheries are given, among others, in the works of De la Peña (1997), Lazola and Samson (1997), and Aripin and Showers (2002) for Sulu Sea; Portugal (1998) for Moro Gulf; and Armada (1998) for Visayan Sea. These studies provide detailed assessments of the status of small pelagic resources and fisheries in the country and the more important fishing grounds. This contribution attempts to provide only a brief update about the small pelagic fisheries and readers are referred to these references for more comprehensive and detailed treatments.

Production Trends

Dalzell *et al.* (1987) and Trinidad *et al.* (1993) documented the historical production trends in small pelagic fisheries since the early 1950s. From production levels of about 100,000 t in the early 1950s, production reached 300,000 t levels during the 1960s and 550,000 t during the mid-1970 to mid-1980 period. Fishing effort from early 1950s to mid-1980s has been noted to have effectively increased almost sixfold.

Table 1 gives the countrywide production (total, commercial and municipal) of small pelagic fishes from 1991 to 2001. The same information is illustrated in Figure 1 to show recent production trends. Total annual production of small pelagics varied between about 695,000 t (1996) and 1,216,000 t (1998) during the period. The peak in production in 1998 is due to peak catches of the municipal fisheries sector of about 639,000 t. Mean annual production of small pelagics during this 11-year period was about 849,000 t, about

[1] This paper can be cited as follows: ZARAGOZA, E.C., C.R. PAGDILAO and E.P. MORENO. 2004. Overview of the small pelagic fisheries, p. 32-37. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 1. Small pelagic fisheries production (t) (BAS statistics for various years).

Year	Municipal	Commercial	Total
1991	292,664	442,324	734,988
1992	302,369	473,043	775,412
1993	250,170	498,316	498,316
1994	235,113	555,540	790,653
1995	245,044	503,332	748,376
1996	229,384	465,426	694,810
1997	268,832	570,215	839,047
1998	638,642	577,331	1,215,973
1999	263,492	571,778	835,270
2000	272,450	577,827	850,277
2001	501,828	604,178	1,106,006

63% coming from the commercial fisheries sector and the rest from municipal fisheries. The increase in catches indicated that fishing effort has further increased during the 1991-2001 period compared to the mid-1980s.

The contribution of various species / groups to total small pelagic fisheries production during 1991-2001 is given in Table 2. The bulk of production is accounted for by sardines (30.6%), roundscads (29.1%), mackerels (17.4%) and anchovies (9.4%). There are differences in the composition of the catches of the commercial and municipal fisheries due to differences in fishing gears used and the ability of the commercial sector to operate further offshore. Commercial production consists principally of roundscads (41.3%) and sardines (34.6%) (Table 3) while municipal production consists of mackerels (32.4%), sardines (23.9%) and anchovies (14.8%) (Table 4).

Major Fishing Gears and Fishing Grounds

A variety of fishing gears are used by commercial and municipal fisheries to exploit the small pelagic resources of the country. The commercial sector uses a smaller variety of fishing gears with production dominantly coming from purse seine (61.6%), ring net (15.7%) and bag net (12.4%) operations (Table 5). The small pelagic catch of the municipal fisheries sector is distributed across a wider variety of fishing gears: gill net (45.5%), hook and line (15.3%), ring net (11.5%), beach seine (8.3%), purse seine (3.7%), fish corral (2.9%) and bag net (2.9%) (Table 6).

The more recent BAS statistical information does not readily allow for disaggregation of production statistics by fishing ground. To provide some information about major fishing grounds for small pelagic fishes, BFAR statistics for 1982-1987 were used. Based on these statistics, the major fishing grounds for small pelagics are Sulu Sea, Visayan Sea, Moro Gulf, Lamon Bay, Cuyo Pass, Guimaras Strait, Western Palawan waters and Manila Bay. The relative contribution of these fishing grounds to small pelagic fisheries production is given in Table 7.

Exports and Imports

Prior to 1986, small pelagics production was mainly used for local consumption. A promising export industry for these fishes commenced when in 1986 alone, a total of 520 t of small pelagics valued at P23 million was exported. From 1987 to 1991, small pelagics

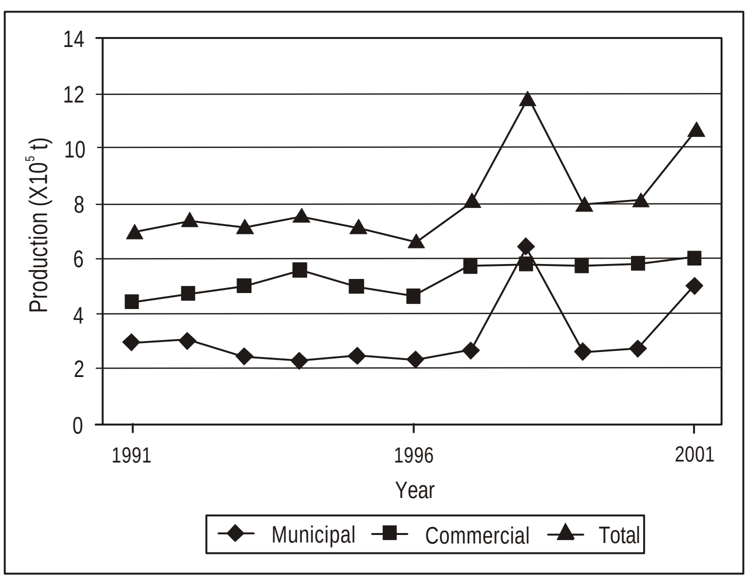


Figure 1. Small pelagic fisheries production (BAS statistics for various years).

Table 2. Total production of small pelagics (t) by species/group (BAS statistics for various years).

Species/Group	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	Distribution (%)
Fusiliers	11,447	13,504	15,479	18,322	13,914	13,798	16,754	15,928	14,952	13,516	14,086	161,700	1.73
Bigeye scads	36,264	37,766	33,438	50,288	43,592	43,660	70,594	61,998	65,776	71,365	79,307	594,048	6.36
Roundscads	277,330	268,466	236,849	258,714	224,373	187,267	228,878	245,143	248,462	255,976	282,787	2,714,245	29.06
Flying fish	19,796	54,112	13,843	14,019	16,826	17,300	27,801	36,135	43,461	36,050	37,498	316,841	3.39
Roundherrings	22,871	22,519	9,415	21,079	19,255	19,441	15,216	20,639	24,080	12,993	13,374	200,882	2.15
Sardines	158,619	195,879	256,744	259,848	265,254	257,744	306,640	297,080	273,882	293,370	288,928	2,853,988	30.56
Anchovies	100,882	84,652	81,437	67,507	71,516	71,456	78,678	77,049	78,087	79,630	82,112	873,006	9.35
Mackerels	107,779	98,514	101,281	100,876	93,646	84,144	94,486	462,001	86,570	87,377	307,914	1,624,588	17.40
Total	**734,988**	**775,412**	**748,486**	**790,653**	**748,376**	**694,810**	**839,047**	**1,215,973**	**835,270**	**850,277**	**1,106,006**	**9,339,298**	**100.00**

Table 3. Commercial production of small pelagics (t) by species/group (BAS statistics for various years).

Species/Group	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	Distribution (%)
Fusiliers	5,485	7,880	6,827	8,457	6,718	6,982	7,937	8,434	7,370	5,753	6,047	77,890	1.33
Bigeye scads	14,351	15,915	14,736	20,653	19,589	21,140	41,829	27,731	29,082	31,760	36,596	273,382	4.68
Roundscads	246,960	245,504	210,304	235,813	200,418	163,761	196,588	216,821	219,519	225,861	250,679	2,412,228	41.31
Flying fish	1,792	2,990	1,953	1,382	2,771	3,527	7,806	11,128	14,324	6,949	7,060	61,682	1.06
Roundherrings	2,602	11,451	8,225	18,626	18,282	18,525	13,788	17,589	21,254	10,437	10,785	151,564	2.60
Sardines	95,375	125,009	181,427	193,113	187,199	184,106	219,334	216,767	197,787	212,539	204,676	2,017,332	34.55
Anchovies	24,297	23,246	28,185	28,346	29,608	32,220	35,518	36,550	38,039	38,348	39,191	353,548	6.05
Mackerels	51,462	41,048	46,659	49,150	38,747	35,165	47,415	42,311	44,403	46,180	49,144	491,684	8.42
Total	**442,324**	**473,043**	**498,316**	**555,540**	**503,332**	**465,426**	**570,215**	**577,331**	**571,778**	**577,827**	**604,178**	**5,839,310**	**100.00**

Table 4. Municipal production of small pelagics (t) by species/group (BAS statistics for various years).

Species/Group	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total	Distribution (%)
Fusiliers	5,962	5,624	8,652	9,865	7,196	6,816	8,817	7,494	7,582	7,763	8,039	83,810	2.39
Bigeye scads	21,913	21,851	18,702	29,635	24,003	22,520	28,765	34,267	36,694	39,605	42,711	320,666	9.16
Roundscads	30,370	22,962	26,545	22,901	23,955	23,506	32,290	28,322	28,943	30,115	32,108	302,017	8.63
Flying fish	18,004	51,122	11,890	12,637	14,055	13,773	19,995	25,007	29,137	29,101	30,438	255,159	7.29
Roundherrings	20,269	11,068	1,190	2,453	973	916	1,428	3,050	2,826	2,556	2,589	49,318	1.41
Sardines	63,244	70,870	75,317	66,735	78,055	73,638	87,306	80,313	76,095	80,831	84,252	836,656	23.90
Anchovies	76,585	61,406	53,252	39,161	41,908	39,236	43,160	40,499	40,048	41,282	42,921	519,458	14.84
Mackerels	56,317	57,466	54,622	51,726	54,899	48,979	47,071	419,690	42,167	41,197	258,770	1,132,904	32.37
Total	**292,664**	**302,369**	**250,170**	**235,113**	**245,044**	**229,384**	**268,832**	**638,642**	**263,492**	**272,450**	**501,828**	**3,499,988**	**100.00**

were exported in the form of canned (64%) and dried (36%) products. Total export from 1987 to 1991 was 4,422 t valued at about P206.2 million. Of the canned products, sardines contributed 92% while mackerels and anchovies contributed 7% and 1%, respectively. Saudi Arabia was the biggest importer (39%) of canned products, particularly sardines. Canned products were also exported to Malaysia (18%), United Arab Emirates (6%) and the USA (2%). During the same period, the country also imported 47,415 t of mackerels and sardines valued at P655.4 million. These were in the form of raw materials for existing canneries.

Key Research and Management Issues

Numerous issues, which impact the utilization and management of small pelagic fisheries resources of the country, are briefly discussed below.

Inadequate statistical and biological information

The statistical information base requires substantive improvement to support site-specific assessment and management of the country's small pelagic fisheries. Data on catch and effort and their spatial distribution need improvement. Overall, the biological information on the country's small pelagic resources is rather scant and fragmentary. Information about the population dynamics of key species / groups requires attention. Ecosystem-based assessments are clearly in order. There is also a need to update countrywide and site-specific assessments (particularly for major fishing grounds) in order to formulate sound management options and sustain the benefits derived from the country's small pelagic fisheries.

Overfishing

Overfishing is, by far, the primary problem facing Philippine small pelagic fisheries. In a biological and economic sense, current fishing pressure has exceeded levels that the resources can sustain. Many fishers targeting small pelagics are hard-pressed in recovering operational costs of fishing as well as vessel and gear depreciation.

Dalzell and Ganaden (1987) provided a maximum sustainable yield estimate of 550,000 t for the small pelagic resources exploited during the mid-1980s. Subsequent refinements of this assessment essentially yielded the same results (Trinidad *et al.* 1993). The MSY figure of 550,000 t, when combined with MSY estimates of about 250,000 t for lightly fished small pelagic resources in the late 1980s (i.e., southern parts of Mindanao, western Palawan waters, parts of the country's Pacific coast), equals a countrywide MSY of about 800,000 t (Munro 1986). Comparison with recent production indicates the occurrence of biological and economic overfishing, particularly in nearshore and traditional fishing grounds. Historical data also show a substantive sixfold reduction in catch rates from the early 1950s to the mid-1980s. Moreover, species-specific assessments of small pelagic fishes in various fishing grounds (Ingles and Pauly 1984; Corpuz *et al.* 1985; Lavapie-Gonzales *et al.* 1997) yielded very high exploitation ratios indicative of overfishing. Collectively, these indicate that exploitation has reached levels which threaten the viability of small pelagic stocks. Assessments indicate the need to decrease fishing pressure by about 50-65% (Dalzell *et al.* 1987; Dalzell and Ganaden 1990; Trinidad *et al.* 1993).

Conflicts between and among commercial and municipal fishers

Given the high fishing pressure evident in small pelagic fisheries, competition and conflict between and among municipal and commercial fishers has increased. Stricter enforcement of exclusive use of municipal fishing grounds by municipal fishers requires attention. Catching of undersized small pelagic fishes (particularly mackerels and bigeye scads) and the use of explosives with fish aggregating devices need to be checked effectively. Regulation of fishing access, effort reduction, wider use of MPAs and effective enforcement are key elements to resolving these conflicts.

Impact of imports

Major industries associated with small pelagic fisheries include fish canning and making of fish sauce (*patis* and *bagoong*). In 1987, the estimated capacity of local canneries was 60,000-70,000 t annually. The bulk of cannery raw materials is currently imported (mostly from Japan). Prior to import liberalization in 1986, 85-90% of local cannery requirements were supplied by domestic small pelagics production. In 1987, only 10% were taken from local production. A continuing debate persists between fish import liberalization in favor of local canneries (which require a regular supply of good quality raw materials) versus limiting imports in support of domestic fish producers. The recent appearance of imported small pelagic fishes in some local market outlets has also caused concern among fishers.

Table 5. Commercial production (t) of small pelagics by gear and by species/group, 1995 (BAS statistics).

Species/Group	Bag Net	Purse Seine	Ringnet	Round Haul Seine	Danish Seine	Beach Seine	Trawl	Gillnet	Hook-and-line	Longline	Troll Line	Push Net	Drive-in Net	Drift Filter Net
Fusiliers	7	6,005	29	0	94	0	75	83	425	0	7	0	0	0
Bigeye scads	791	8,918	5,367	4	1,451	0	571	253	2,619	2	0	1	0	0
Roundscads	27,505	165,820	31,622	5	6,108	11	5138	177	21	584	0	0	0	0
Flying fish	80	211	1,391	0	1	0	0	1,083	18	6	0	0	0	0
Roundherrings	995	11,927	3,467	0	289	1	1,639	2	5	0	0	3	0	0
Sardines	21,442	121,242	31,854	28	2,653	104	11,386	740	12	1,961	0	215	0	0
Anchovies	14,114	1,283	6,875	1,206	424	280	3,393	991	16	0	0	1,026	0	0
Mackerels	2,790	20,732	4,979	100	7,271	0	3,096	299	176	220	0	10	0	1
Total	**67,724**	**336,138**	**85,584**	**1,343**	**18,291**	**396**	**25,298**	**3,628**	**3,292**	**2,773**	**7**	**1,255**	**0**	**1**

Table 6. Municipal production (t) of small pelagics by gear and by species/group, 1995 (BAS statistics).

Species/Group	Bag Net	Fish Corral	Baby Trawl	Beach Seine	Purse Seine	Ring Net	Gill Net	Round Haul Seine	Danish Seine	Hook-and-Line	Drive-in Net
Fusiliers	0	109	1	15	0	53	3,235	2	0	2,328	1
Bigeye scads	22	397	1	286	1,539	2,154	4,614	439	87	17,300	10
Roundscads	367	83	1,559	980	502	6,219	6,901	132	64	4,620	1
Flying fish	224	6	13	338	1,530	1,424	8,437	412	0	275	947
Roundherrings	11	3	15	232	0	3	395	0	0	149	102
Sardines	1,670	2,499	78	4,217	551	12,743	50,217	49	269	4,099	53
Anchovies	4,782	3,858	21	13,437	1,713	2,576	7,072	1,118	164	265	21
Mackerels	27	251	18	732	3,218	3,102	30,528	17	565	8,493	95
Total	**7,103**	**7,206**	**1,706**	**20,237**	**9,053**	**28,274**	**111,399**	**2,169**	**1,149**	**37,529**	**1,230**

Species/Group	Longline	Troll Line	Pole and Line	Jigger	Lift Net	Crab Lift Net	Cast Net	Push Net	Filter Net	Drift Filter Net	Fish Pot	Spear	Others
Fusiliers	100	10	2	0	0	0	0	0	7	16	376	931	10
Bigeye scads	468	110	22	149	0	0	0	0	23	1	197	80	481
Roundscads	458	384	9	1	16	0	0	168	0	1,322	77	13	79
Flying fish	9	440	0	0	0	0	0	0	0	0	0	0	10
Roundherrings	19	8	0	0	2	0	0	8	0	230	0	0	0
Sardines	195	1	0	3	98	22	1	43	88	10	16	0	358
Anchovies	36	0	0	0	1,335	0	8	253	52	0	112	6	5,079
Mackerels	712	159	1	240	5	1	7	199	2,111	0	34	101	488
Total	**1,997**	**1,112**	**34**	**393**	**1,456**	**23**	**16**	**671**	**2,281**	**1,579**	**812**	**1,131**	**6,505**

Table 7. Top 10 fishing grounds for small pelagics by gear, 1982-1987 (BFAR statistics for various years).

Fishing Area	Mean Production (1982-1987)	Contribution (%)
West Sulu Sea	44,900	20.61
Visayan Sea	41,793	19.18
East Sulu Sea	29,240	13.42
South Sulu Sea	27,068	12.42
Moro Gulf	20,933	9.61
Lamon Bay	15,106	6.93
Cuyo Pass	13,127	6.02
Guimaras Strait	10,261	4.71
West Palawan Waters	8,392	3.85
Manila Bay	7,068	3.24
Total	**217,888**	**100.00**

Post-harvest losses

Current post-harvest practices result in high rates of spoilage, especially during peak season of production. It is estimated that as much as 50,000 t of potential raw materials for canning are lost to spoilage during the peak fishing season. Results of a study conducted in the fish landings in Navotas, Zambales, Bicol, Cavite and Quezon show that as much as 40% of commercial landings are in various stages of spoilage. If a similar rate occurs in all landing sites across the country, the potential amount lost to the supply of fresh small pelagic fish may be as much as 200,000 t annually. While better post-harvest handling is warranted, many commercial and municipal fishers are wary of the additional costs. Taking more ice entails higher costs and reduces fish storage capacity. Lower-quality fish are sold to fish sauce makers and still allow fishers to make profits without the additional costs of improved post-harvest handling. Innovative measures are needed to reduce spoilage and value losses, increase fresh fish supply to consumers and maximize the use of catches extracted from our dwindling small pelagic fish stocks.

References

Aripin, I.E. and P.A.T. Showers. 2002. Population parameters of small pelagic fishes caught off Tawi-Tawi, Philippines. Naga 23(4): 21-25.

Armada, N.B. 1998. Assessment and management of small pelagic fisheries in Visayan Sea. Annual Project Report (August 1996-July 1997). College of Fisheries and Ocean Sciences, University of the Philippines in the Visayas, Iloilo, Philippines. 28 p.

Calvelo, R. and P. Dalzell. 1987. A review of the recent status of exploited stocks of roundscads in the Philippines. Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia, Darwin, Australia, 16-19 February 1987. Indo-Pacific Fisheries Commission and Regional Office for Asia and the Pacific, FAO, Bangkok. Inf. Pap. 9, 27 p.

Corpuz, A., J. Saeger and V. Sambilay, Jr. 1985. Population parameters of commercially-important fishes in Philippine waters. College of Fisheries, University of the Philippines, Quezon City, Philippines. Tech. Rep. Dept. Mar. Fish. No. 6, 99 p.

Dalzell, P. and P. Corpuz, 1990. The present status of small pelagic fisheries in the Philippines, p. 25-51. *In* C.R. Pagdilao and C.D. Garcia (eds.) Philippine tuna and small pelagic fisheries: Status and prospects for development. PCAMRD Book Ser. No. 7, 160 p. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines.

Dalzell, P. and R. Ganaden. 1987. A review of the fisheries for small pelagic fisheries in Philippine waters. BFAR Tech. Pap. Ser. X (1), 58 p. International Center for Living Aquatic Resources Management, Manila, and Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Dalzell, P., P. Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. BFAR Tech. Pap. Ser. X (3), 23 p. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

De la Peña, H.P. 1997. Assessment and management of small pelagic fisheries in (West) Sulu Sea. Project Report. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines. 50 p.

Ingles, J. and D. Pauly. 1984. An atlas of the growth, mortality and recruitment of Philippine fishes. ICLARM Tech. Rep. 13, 127 p.

Lavapie-Gonzales, F. S., R. Ganaden and F.C. Gayanilo, Jr. 1997. Some population parameters of commercially-important fishes in the Philippines. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 114 p.

Lazola, N.T. and R. Samson. 1997. Assessment of small pelagic fisheries in (East) Sulu Sea. Project Report. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines. 55 p.

Munro, J. 1986. Marine fishery resources in the Philippines: Catches and potential, p. 19-45. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socio-economics of Philippine marine fisheries. College of Fisheries, University of the Philippines-Visayas, Quezon City, Philippines. Dept. Mar. Fish. Tech. Rep. 10, 217 p.

Pagdilao, C.R., A.C. Corpuz and E. Moreno. 1993. Status of the small pelagic fisheries industry. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines. PCAMRD-DOST Primer No. 21, 36 p.

Portugal, C.N. 1998. Assessment of small pelagic fisheries in Moro Gulf. Project Terminal Report. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines. 80 p.

Trinidad, A.C., R.S. Pomeroy, P.V. Corpuz and M. Aguero. 1993. Bioeconomics of the Philippine small pelagic fishery. ICLARM Tech. Rep. 38, 74 p.

Fisheries for Tuna and Other Large Pelagic Fishes[1]

ESTER C. ZARAGOZA
CESARIO R. PAGDILAO
ERIBERTO P. MORENO
Philippine Council for Aquatic and Marine Research and Development
Department of Science and Technology
Los Baños, Laguna
Philippines

Introduction

Large pelagic fishes consist of tunas and tuna-like species, such as billfish, swordfish and marlin. These comprise a special group of highly migratory fishes capable of attaining large sizes (adult bluefin tuna usually weigh about 500 kg) and spends their entire life in marine waters (from coastal areas to high seas). The tuna fisheries became the largest and most valuable fisheries in the Philippines during the mid-1970s when bamboo rafts (or *payao*, a fish aggregating device), were introduced. In 2001, tuna fisheries production was about 352,500 t or 19.7% of total Philippine fisheries production.

The country became the number one producer of tunas in Southeast Asia in the 1980s. When the catch rate of tunas in Philippine waters started declining in the late 1980s, Filipino fishing companies started to fish in international waters. This made the Philippines one of the distant-water fishing nations in the Pacific, in addition to the US, Japan, Korea, Taiwan and China.

Twenty-one species of tuna have been recorded in Philippine waters but only six are caught in commercial quantity and form the basis of the tuna fishing industry. Of the six species, only four form the bulk of catches and are listed in Philippine fisheries catch statistics, namely: yellowfin (*Thunnus albacares*), skipjack (*Katsuwonus pelamis*), eastern little tuna or *kawa-kawa* (*Euthynnus affinis*) and frigate tuna (*Auxis thazard*). Tuna-like fishes recorded in Philippine waters include the swordfish, *Xiphias gladius*, and a number of istiophorid fishes. Their catch is relatively low compared to the tuna catch.

Production Trends

Annual tuna production increased from less than 10,000 t in 1970 to about 200,000 t in the late 1980s (Aprieto 1995a, 1995b). By the 1990s, annual production has increased substantially to the 300,000 t level and comprised on average about 20% of the total annual marine fisheries production. During 1991 to 2001, tuna production varied between about 243,300 t (1993) and 352,500 t (2001) (Figure 1). The commercial fisheries sector consistently produced a greater proportion of the catch. It accounted for 61.7% of the mean annual tuna production of about 313,600 t during the period, with the municipal sector accounting for 38.3%.

The annual production of tuna by species/ group during the period 1991-2001 is given in Table 1. Cumulative catches during the period was dominated by frigate and yellowfin tuna, which contributed 35.4% and 31.5%, respectively. Skipjack and eastern little tuna contributed 22.6% and 10.5%, respectively, of cumulative catches during the period. Yellowfin and skipjack are mainly exported while the rest of the tuna species are consumed locally. These two species accounted for about 50% of the annual tuna catch. The catch of yellowfin varied between 68,000 t and 116,000 t during the period. The skipjack catch reached a peak of about 95,600 t in 1991 and declined to about 38,200 t by 1993. It has recovered since, reaching a high of about 96,500 t by 2001. Frigate tuna catch reached a peak of about 158,500 t in 1997, and was at 115,900 t in 2001. Eastern little tuna catch peaked at about 54,500 t in 1995, and has varied between 24,400 t and 28,000 t in subsequent years indicating a substantial decline in production.

---

[1] This paper can be cited as follows: ZARAGOZA, E.C., C.R. PAGDILAO and E.P. MORENO. 2004. Fisheries for tuna and other large pelagic fishes, p. 38-41. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

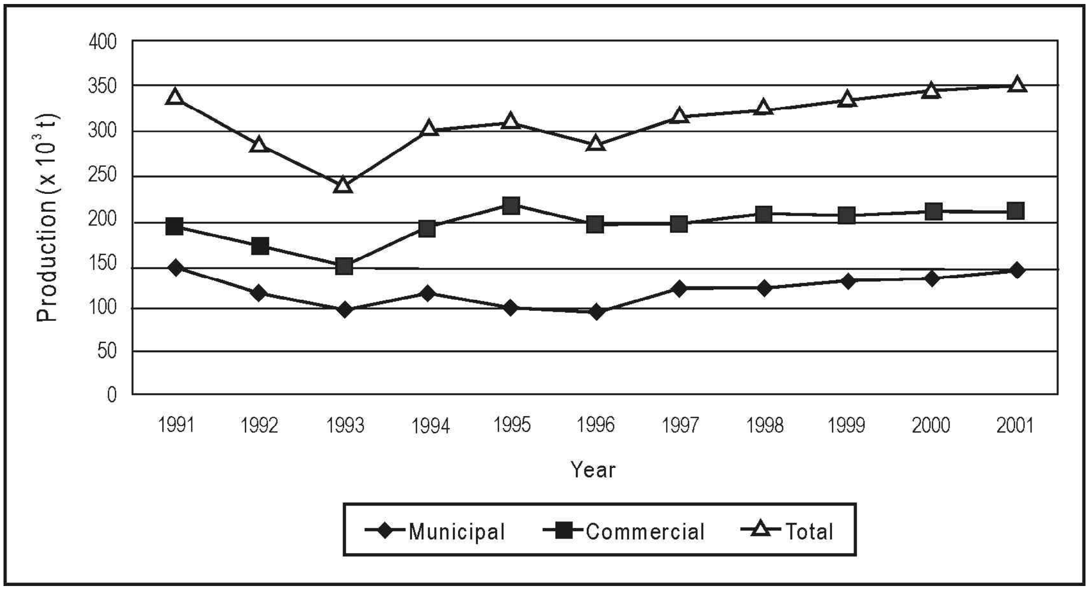


Figure 1. Annual production (t) of tuna (total, commercial and municipal), 1991-2001 (BAS 1991-2001).

Table 1. Annual production (t) of tuna by species/group, 1991-2001 (BAS 1991-2001).

Species/Group	1991	1992	1993	1994	1995	1996	1997
Frigate	93,236	125,655	110,357	109,887	88,426	88,969	158,494
Yellowfin	102,394	83,179	68,081	84,560	109,473	110,041	77,097
Skipjack	95,594	45,026	38,198	64,080	61,171	63,415	55,147
Eastern little tuna	47,850	31,943	26,670	46,221	54,486	24,472	26,663
Total	**339,074**	**285,803**	**243,306**	**304,748**	**313,556**	**286,897**	**317,401**

Species/Group	1998	1999	2000	2001	Total	% contribution
Frigate	106,433	111,301	112,227	115,905	1,220,890	35.4
Yellowfin	116,673	108,778	113,011	112,238	1,085,525	31.5
Skipjack	79,215	90,353	90,328	96,450	778,977	22.6
Eastern little tuna	24,424	25,406	27,963	27,890	363,988	10.5
Total	**326,745**	**335,838**	**343,529**	**352,483**	**3,449,380**	**100.0**

There are differences in the species composition of commercial and municipal tuna catches. Cumulative catches during 1991-2001 indicate that commercial fisheries tuna catch consisted of: yellowfin, 38.7%; frigate tuna, 31.4%; skipjack, 18.0%; and eastern little tuna, 11.9%. The municipal fisheries tuna catch during the same period was: frigate tuna, 41.8%; skipjack, 30.0%; yellowfin, 19.8%; and eastern little tuna, 8.4%.

Catches of other large pelagic fishes such as marlin, swordfish and sailfish are lower compared to tuna catches. From landings of about 17,000-25,000 t in the 1970s, these have declined to about 9,000-15,000 t in the 1980s. In 1995, production was down to about 5,500 t. Little is known locally about the billfish and swordfish resources due to incomplete statistics and inadequate information on their biology.

Major Fishing Grounds and Gears

Tunas are caught throughout Philippine waters but the most productive fishing grounds are the Sulu Sea, Moro Gulf and waters extending to the north Celebes Sea. Over 55% of the total skipjack and yellowfin catch, however, is taken from waters around Mindanao. Viable tuna fisheries also exist in waters off Western Negros, as well as Northwestern and Southern Luzon. Specific locations of tuna fishing grounds are highly guarded trade secrets by fishers. However, the advent and wide use of *payao* (fish aggregating devices) has largely eliminated such secrecy. The location of *payao* areas is a good indication of productive tuna fishing grounds.


Tuna catch in General Santos City fish landing site.

A variety of fishing gears are used to catch tuna. The use of purse seines, ringnets and handlines usually account for over 80% of the annual tuna catch. For instance, the commercial fisheries catch in 1995 was caught by: purse seine, 47.6%; ringnet, 40.2%; line gears (hook and line, longline and troll line), 8.8%; gillnet, 1.6%; bagnet, 1.4%; and other gears, 0.4%. The use of purse seine alone makes up nearly half of the commercial catch of tuna. The municipal fisheries employ a wider variety (over 21 different types) of fishing gears to catch tunas. In 1995, the tuna catch of municipal fisheries was caught by: hook and line, 56.3%; gillnet, 13.1%; ringnet, 9.3%; troll line, 6.9%; purse seine, 5.3%; longline, 2.7%; beach seine, 2.7%; fish corral, 1.5%; and other gears, 2.2%. The line gears alone account for over 60% of the municipal harvest.

Except for the large commercial purse seine and ringnet boats (250-490 GT) that are capable of offshore and deep-sea fishing, most of the tuna fishing fleets operate in nearshore waters. Most of these boats operating nearshore catch young, juvenile tuna, as well as small pelagic fishes (particularly roundscads, sardines, bigeye scads and moonfishes) which are harvested in the same surface fishing operations using nets (Pagdilao *et al.* 1993; Barut 1999).

The *payao* has been singled out as the most important factor that triggered the phenomenal development of the tuna fishing industry. The effectiveness and efficiency of *payao* in attracting tuna (especially yellowfin and skipjack) greatly reduced the time spent in searching and fishing for commercial volumes. Both commercial and municipal fishers use *payao* in attracting tunas and oftentimes share the same *payaos* deployed in the fishing grounds. The commercial fishing boat operators catch the surface aggregating juveniles, while the municipal fishers, with the use of handlines, catch adult yellowfin (110–150 cm) occupying the deeper water column (Aprieto 1995b).

The extensive use of *payao*, however, may be rapidly removing undersized juveniles from the stocks and altering migration and feeding patterns of tunas in Philippine waters. Moreover, many coastal countries have adopted the *payao* in tuna fishing. Tuna studies in Mindanao waters show that more than 90% of yellowfin and skipjack tuna landed by purse seine, bagnet and ringnet are less than 12 months old (Aprieto 1995a, 1995b).

Tuna Trade

The Philippine international trade in tuna and tuna products involves the export of about 30-40% of tuna production. Tuna is exported fresh/chilled, frozen or canned. In 2001, the total export of fish and fisheries products was valued at PhP22.7 billion. Of these, tuna and tuna products accounted for about 27% or PhP5.87 billion (BAS 2001). These export data, however, may not be very accurate since spot buying in fishing grounds by foreign companies is very common. Japan, US, Thailand and Taiwan are the major market destinations of fresh/chilled and frozen tuna products. Canned tuna production grew considerably in the 1980s and early 1990s. Up to 22% of canned tuna exports are sent to US, 17% to Germany, 15% to Canada and the rest to 21 other countries in Europe, the Middle East, Africa and Asia.

Philippine frozen tuna imports increased from basically zero in the early 1980s to a peak of 53,400 t valued at US$34.5 million in 1992 (BAS 1992). In 2001, large quantities (19,300 t valued at PhP442.3 million) of frozen tuna were imported from Papua New Guinea, Taiwan, Indonesia, Singapore and the US Trust Territories (BAS 2001).

Main Research and Management Issues

A host of issues have impact on the sustainable use and management of large pelagic fisheries in the Philippines. Following are the main issues:

- Inadequate statistical baselines - Catch and effort data are inadequate for purposes of effective fisheries management. There are no reliable data on the number of licensed and unlicensed commercial purse seiners, ringnetters and longliners. Information on the number of small and large-scale fishing boats using tuna handline is also inadequate.

- Inadequate biological information - There is still a dearth of information on tuna biology, despite the three major tuna research programs – Food and Agriculture Organization-Bureau of Fisheries and Aquatic Resources Tuna Research Program, Regional Tuna Tagging Program and Philippine Tuna Research Project - conducted in the Philippines. Sustained efforts to gather information on the reproductive biology, migration, growth, abundance, and distribution of tuna in traditional and nontraditional fishing grounds are needed.
- Exploitation of undersized tunas - A substantial portion of tuna catches consists of undersized fishes that are immature and have yet to grow and add more weight. Despite inadequacies in the statistical baselines and biological information, available studies document this issue, leading to concerns about growth and recruitment overfishing.
- Poor post-harvest handling - Substantial losses in value of harvested fish and reduction of incomes often result from poor post-harvest handling methods and facilities. Improvement of rural transportation infrastructure, as well as strategic location of ice plant and cold storage facilities, requires concerted action. Extension activities to improve handling methods and marketing of catches, particularly in the municipal sector, need government attention.
- Excess tuna canning capacity - There is evident underutilization of production capabilities of existing local tuna canneries. Assessment of measures to effectively address this issue requires attention. Allowing importation of raw materials under the government's trade liberalization policies should consider the wider interests of the whole fishing industry.
- Boundary disputes - Uncertainties and disputes regarding marine boundaries with adjacent coastal states (e.g., Malaysia, Indonesia, Taiwan, China and Vietnam) pose much difficulties to fishers exploiting tuna and other large pelagic fishes. Settlement of these uncertainties deserves increased attention.
- Lack of joint management arrangements - As large pelagic fishes are highly migratory, bilateral and regional fishing and management arrangements with neighboring countries should be pursued. Joint venture fishing arrangements by the private sector with companies in neighboring countries have been in existence for some time. These can be built upon to promote collaborative management and sustainable use of shared resources at official levels for the benefit of countries in the region.

References

Aprieto, V.L. 1995a. Assessment of the tuna industry, p.209-236. *In* DOST (Department of Science and Technology)-UNDP (United Nations Development Programme). Project for Achieving International Competitiveness through Technology Development and Transfer Assessment. Reports. Module 1: Export winners. DOST, Manila, Philippines.

Aprieto, V.L. 1995b. Philippine tuna fisheries - yellowfin tuna and skipjack. University of the Philippines Press, Quezon City, Philippines.

Barut, N.C. 1999. The effects of the El Niño on tuna stocks in the Philippines, p. 32-43. *In* H.R. Rabanal (ed.) 1999. Impacts of El Niño on Philippine fisheries. Proceedings of the National Workshop on the Assessment of the Impacts of El Niño on Philippine Fisheries, 20-21 August 1998, Laguna, Philippines. PCAMRD Book Ser. No. 27/1999, 228 p.

BAS (Bureau of Agricultural Statistics). 1991-2001. Fisheries statistics of the Philippines. BAS, Quezon City, Philippines. Var. p.

Pagdilao, C.R., A.C. Corpuz and E. Moreno. 1993. Status of small pelagic fisheries industry. PCAMRD-DOST Primer No. 21, 36 p.

State of the Demersal Fisheries[1]

NYGIEL B. ARMADA
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo 5023
Philippines

Introduction

Bottom trawl used to be the major fishing gear employed to catch demersal fishes in the country from the late 1940s until the mid-1980s. There was tremendous improvement in the trawl design from the simple beam trawl used after World War II to high-opening, modified Hermann Engel trawl in the late 1970s. Such gear, together with improved vessel design and increased engine horsepower, lead to increased catching efficiency and capacity. However, due to increases in fuel prices and depletion of demersal resources, trawl operations eventually dwindled and were practically replaced by more fuel-efficient Danish seines.

Major trawlable fishing grounds in the country are found in the soft bottom areas of Lingayen Gulf, Manila Bay, Tayabas Bay, Ragay Gulf, Samar Sea, Carigara Bay, Visayan Sea, Guimaras Strait and Sibuguey Bay. However, narrow strips of trawlable grounds are likewise found in various inland waters of the archipelago.

Decline of Demersal Trawlable Biomass: The Obvious Consequence

The state of demersal stocks in the Philippines is clearly shown by the decline in trawlable biomass during the past five decades. The decline can be observed from the results of over 40 demersal trawl surveys conducted in the country from 1947 to 1995. The densities of the demersal stocks were estimated using the "swept area" method. The trawl is known to sweep a definite path which area is the product of the distance of the trawl run and the effective width of the trawl.

The first of these surveys was conducted by Warfel and Manacop (1950) from 1947 to 1949 for the entire Philippine archipelagic waters to explore the potential trawlable areas of the country. Other trawl surveys conducted after this were confined to very specific areas like bays, gulfs or particular trawl fishing grounds. Generally, the purpose was to determine the demersal resource potential of each specific area or fishing ground. Survey vessels and trawl gear sizes and designs vary from one survey to the other. Trawl fishing was conducted either on board research vessels, commercial trawlers or small-scale trawlers. Trawl gears used vary from beam trawls to two-seamed trawl nets to four-seamed high opening nets.

The survey conducted by Warfel and Manacop (1950) was exploratory in nature. Sampling stations were not pre-established and no standard fishing time was used. The drag lasted between 50 and 180 minutes, depending upon the nature of the seabed. In many of the area-specific trawl surveys, sampling stations were pre-established and in most cases sampling was replicated monthly for a period of one year. For relatively shallow fishing grounds, the survey areas were stratified into 10-m depth intervals while deeper fishing grounds were stratified into 50-m depth intervals. Trawl stations were distributed proportionate to the size of each stratum. The standard duration of a trawl dragging operation is one hour. However, for small survey areas and fishing grounds with plenty of seabed obstruction, only 30-minute dragging on each station was undertaken. When the net had to be hauled before the designated fishing duration, e.g., during snags or when avoiding obstructions, the catches were raised to the standard time.

[1]This paper can be cited as follows: ARMADA, N.B. 2004. State of the demersal fisheries, p. 42-46. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Figure 1 shows the overall trend of trawlable demersal biomass decline in the Philippines. Demersal biomass through time was estimated using data from different trawl surveys conducted from 1947 to 1995. Silvestre *et al.* (1986) provided the estimates using trawl surveys conducted from 1947 to 1980, while the rest were consolidated from recent trawl surveys in Lingayen Gulf (Silvestre *et al.* 1991), Ragay Gulf and Burias Pass (Federizon 1993), Manila Bay (Armada 1994), San Miguel Bay (Cinco *et al.* 1995), San Pedro Bay (Armada 1996) and Tayabas Bay (Resources Combines 1997). For comparison through time, the catch rates and biomass estimates were corrected for "learning effects" by incorporating correction factors given by Silvestre *et al.* (1986). The consolidated time series of information on demersal biomass clearly indicate a trend of decreasing demersal stock in all depth strata during the past 50 years. Grouped into geographic sectors belonging to Western, Central and Eastern Philippines, the same set of information indicates the same pattern of decline (Figure 2). Higher biomass estimates were recorded in a number of trawlable areas in Western and Eastern Philippines before the 1970s, especially in deeper areas. Although biomass decline was also observed in Central Philippines, no such extreme values were recorded.

Change in Composition of Demersal Stocks: The Less Obvious Consequence

Decline in demersal biomass is not the only effect of excessive fishing of demersal resources by trawls and other gears. A less obvious effect is manifested in the species composition of the catch. Increases in fishing effort may not necessarily lead to declines in catch but instead result in changes in species composition. The most noticeable is the increase in squid abundance in relation to fish biomass, as shown by Pauly (1979) in the Gulf of Thailand and Silvestre *et al.* (1991) in Lingayen Gulf. In Manila Bay, an increase in shrimp and squid in the catch and a decrease of large-size fish species was already noted in the early 1980s (Silvestre *et al.* 1987). Back in 1947, invertebrates were not part of the catch during the trawl survey conducted by Warfel and Manacop (1950). But results of a 1993 trawl survey show that they contributed 25% of the catch by that time.

Classified into families, a significant change in catch composition was observed from the 1947 and 1993 trawl surveys in Manila Bay (Figure 3). Recognized as ecosystem overfishing (Pauly *et al.* 1989), the major changes in catch composition include an increase in abundance of squids, shrimps and small pelagic species like herrings and anchovies; disappearance of turbots and lactarids; and substantial declines in the abundance of large, commercially valuable species like snappers, sea catfish and Spanish mackerels. The same trends have been noted in the Gulf of Thailand (Pauly 1979), San Miguel Bay (Pauly 1982) and Lingayen Gulf (Silvestre *et al.* 1991).

The Need for Improved Management: Have We Missed the Boat?

The decline in demersal biomass and composition of trawlable fish stocks was already noticed as the country's trawl fishing fleet was expanding. In Manila Bay, declining catch rates of the trawlers were already observed in the second half of the 1950s due to the rapid expansion of the fleet (Ronquillo *et al.* 1960). Several studies were also able to document high trawl extraction rates (yield to biomass ratio) of demersal stocks in traditional fishing grounds. In San Miguel Bay and Lingayen Gulf, extraction rates of 3.6 and 2.8, respectively, were estimated in the 1980s (Vakily 1982; Silvestre *et al.* 1991). These and other similar information should have been heeded as warning – and the country's fishery biologists never fell short of it.

Ronquillo *et al.* (1960) noted that the trawl fishery in Manila Bay in the second half of the 1950s has probably reached its maximum sustainable yield, such that an increase in the number of fishing vessels resulted in a decrease in their annual average landings. Silvestre *et al.* (1987) showed the need to reduce the fishing effort on the demersal stock in Manila Bay to one-third of the 1983-1984 level to be able to attain an economic rent of US$1.5–4.8 million. Furthermore, Armada (1994) showed that the demersal trawlable biomass of Manila Bay went down from 4.61 t/km^2 in 1947 to 0.47 t/km^2 in 1992. As early as 1988, Silvestre *et al.* (1991) advocated for a reduction of trawlers and Danish seiners and non-issuance of licenses for new fishing vessels in Lingayen Gulf to reduce fishing effort.

To sum up, the need to manage exploitation of the demersal fishery resources has already been recognized as early as the 1960s and echoed for several decades afterwards. Since the major cause of overextraction is the high fishing effort, its reduction would have been the logical course of action. In fact, Saeger (1981) showed that banning of commercial trawl fishing alone could cause the doubling of demersal biomass in just one year. The benefit from mesh size regulation has also been shown. Silvestre and Soriano (1986) showed that the mesh size of 2 cm used by trawlers in Samar Sea is counterproductive for the species mix being exploited and increases in yield can

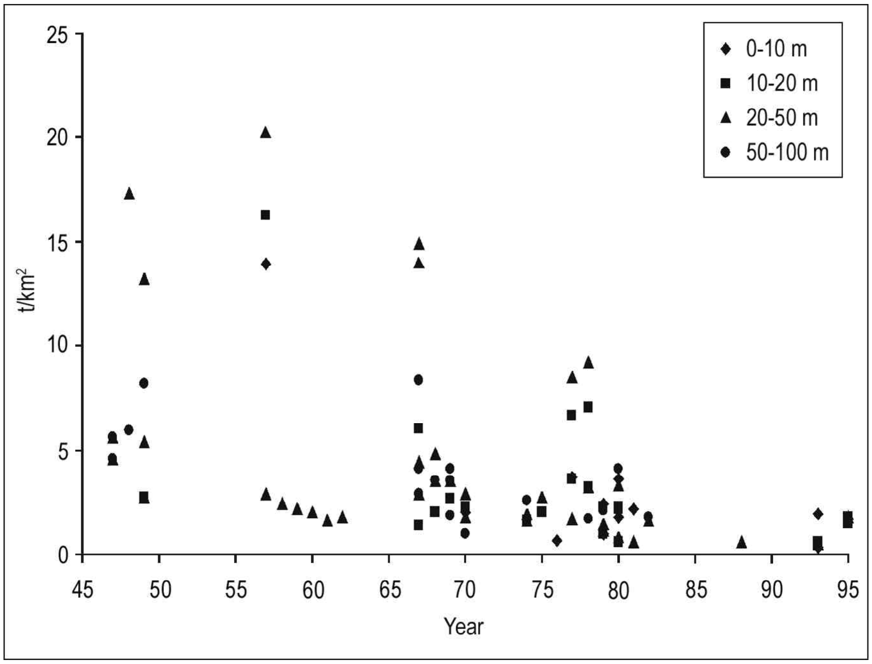


Figure 1. Overall trend of decline of trawlable demersal resources in the Philippines.

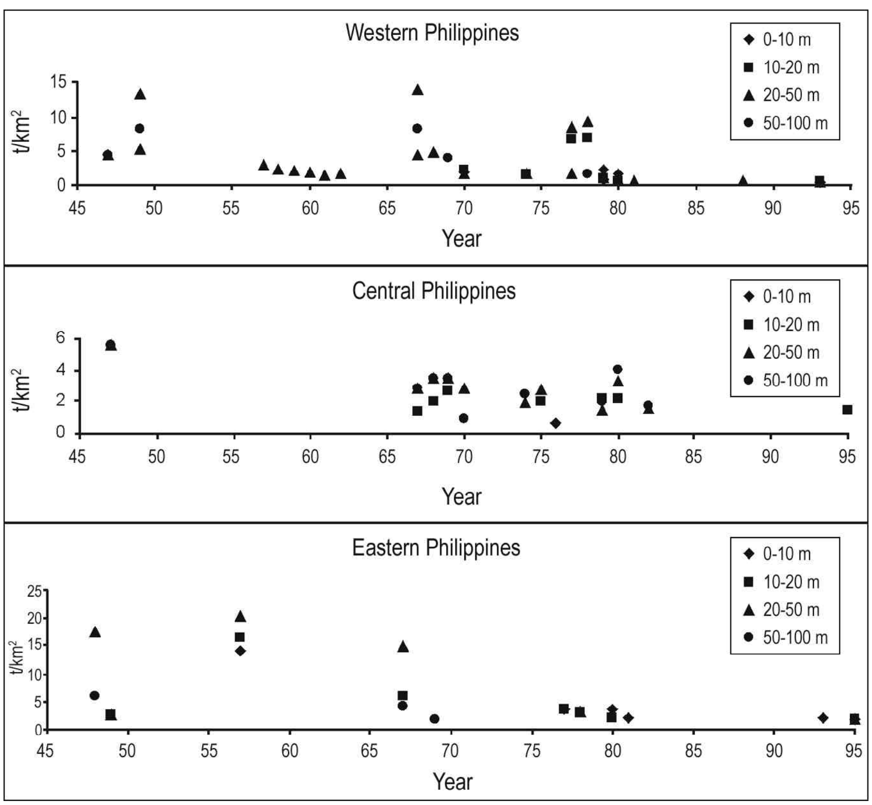


Figure 2. Trend of demersal stock decline in Western, Central and Eastern Philippines.

be attained at various fishing pressure if the legal mesh size of 3 cm is adhered to. Armada (1996) estimated that an increase in annual harvest of 14% can still be attained and likewise sustained if only the fishers adhered to the legal mesh size of 3 cm in San Pedro Bay.

In its current state, it will take time for demersal resources to recover. Drastic actions like banning of trawls and Danish seines may cause the biomass to increase rapidly for shorter periods of time. However, this increase may not mean improvement of the catch in general. It will take much longer to regain the stock of large demersal species which have been practically eliminated due to uncontrolled fishing.

References

Armada, N.B. 1994. Capture fisheries of Manila Bay. Final report on capture fisheries component of the resource and ecological assessment of Manila Bay. Fisheries Sector Program, Department of Agriculture, Quezon City, Philippines.

Armada, N.B. 1996. Trawl survey of San Pedro Bay, Philippines. Vol. 5: The fisheries of San Pedro Bay, Philippines. IMFO Tech. Rep. No. 16: 41-55. Institute of Marine Fisheries and Oceanology, College of Fisheries, University of the Philippines in the Visayas, Iloilo, Philippines.

Cinco, E., J. Diaz, R. Gatchalian and G. Silvestre. 1995. Results of the San Miguel Bay trawl survey. *In* G. Silvestre, C. Luna and J. Padilla (eds.) Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1992-1993). ICLARM Tech. Rep. 47 (CD-ROM). ICLARM, Manila, Philippines.

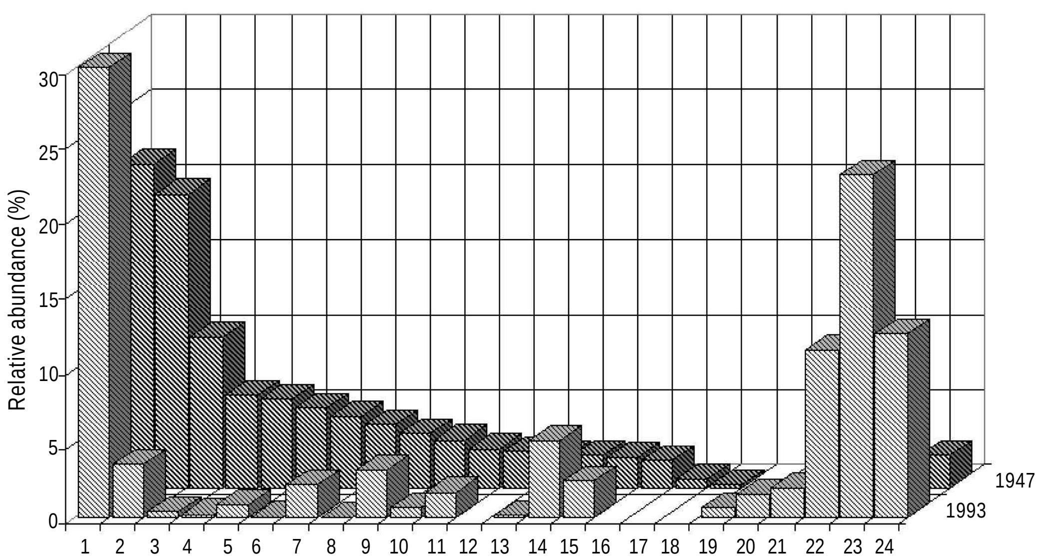
Federizon, R. 1993. Using vital statistics and survey catch composition data for tropical multispecies fish stock assessment: Application to the demersal resources of the Central Philippines. University of Bremen, Germany. 201 p. Ph.D. dissertation.

Pauly, D. 1979. Theory and management of tropical multispecies stocks: A review, with emphasis on the Southeast Asian demersal fisheries. ICLARM Stud. Rev. 1, 35 p.

Pauly, D. 1982. History and present status of the fisheries, p. 95-124. *In* D. Pauly and A. Mines (eds.) Small-scale fisheries of San Miguel Bay Philippines: Biology and stock assessment. ICLARM Tech. Rep. 7, 124 p.

Pauly, D., G. Silvestre and I. Smith. 1989. On development, fisheries and dynamite: A brief review of tropical fisheries management. Nat. Resour. Modeling 3(3): 307-329.

Resources Combines. 1997. Introduction and assessment of fishery resources. Vol. 1. Resource and ecological assessment of Tayabas Bay. Fisheries Sector Program, Department of Agriculture, Quezon City, Philippines.



Legend:

#	Family	#	Family	#	Family	#	Family
1	Leiognathidae	7	Sciaenidae	13	Serranidae	19	Shrimps
2	Trichiuridae	8	Ariidae	14	Carangidae	20	Clupeidae
3	Lutjanidae	9	Mullidae	15	Gerreidae	21	Theraponidae
4	Synodontidae	10	Scombridae	16	Psettodidae	22	Engraulidae
5	Nemipteridae	11	Sphyraenidae	17	Lactaridae	23	Squids
6	Pomadasyidae	12	Dorosomidae	18	Meneidae	24	Miscellaneous

Figure 3. Catch composition (grouped into families) obtained from trawl surveys conducted in Manila Bay in 1947 and 1993, illustrating changes in demersal stock composition.

Ronquillo, I.A., P. Caces Borja and A.N. Mines. 1960. Preliminary observations on the otter trawl fishery of Manila Bay. Philipp. J. Fish. 8(1): 47-57.

Saeger, J. 1981. Do trawling bans work in tropical waters? ICLARM Newsl. 3(4): 3-4.

Silvestre, G.and M. Soriano. 1986. Effects of incorporating sigmoid selection on optimum mesh size estimation for the Samar Sea multispecies trawl fishery, p. 482-492. *In* S.C. Venema, J.M. Christensen and D. Pauly (eds.) Contributions to tropical fisheries biology: Papers from the FAO/DANIDA Follow-up Training Courses on Fish Stock Assessment in the Tropics, 5-30 May 1986, Hirtshals, Denmark, and 12 January - 6 February 1987, Manila, Philippines. FAO Fish. Rep. (389), 519 p.

Silvestre, G., N. Armada and E. Cinco. 1991. Assessment of the capture fisheries of Lingayen Gulf, Philippines, p. 25-36. *In* L.M. Chou, T.-E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong (eds.) Towards an integrated management of tropical coastal resources. ICLARM Conf. Proc. 22, 455 p.

Silvestre, G., R. Regalado and D. Pauly. 1986. Status of Philippine demersal stocks – inferences from underutilized catch rate data, p. 47-96. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socio-economics of Philippine marine fisheries. Dept. Mar. Fish. Tech. Rep. 10, 217 p.

Silvestre, G., R. Federizon, J. Muñoz and D. Pauly. 1987. Over-exploitation of the demersal resources of Manila Bay and adjacent areas. Paper presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia, 16-19 February 1987, Darwin, Australia.

Vakily J.M. 1982. Catch and effort in the trawl fishery, p. 65-94. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: Biology and stock assessment. ICLARM Tech. Rep. 7, 124 p.

Warfel, H. and P. Manacop. 1950. Otter trawl explorations in Philippine waters. Res. Rep. 25, 49 p. US Department of the Interior, Fish and Wildlife Service, USA.

Status of the Blue Crab Fisheries in the Philippines[1]

JOSE A. INGLES
Sulu-Sulawesi Marine Ecoregion Program
World Wide Fund for Nature (WWF) - Philippines
LBI Bldg., 57 Kalayaan Ave., Diliman, Quezon City
Philippines

Introduction

Crabs are one of the most important invertebrate resources taken from our seas and contribute significantly to global food supply. According to 2002 FAO statistics, *Portunus pelagicus*, also known as the blue swimming crab or manna crab, contributed 0.19% of world production from capture fisheries.

In the Philippines, blue crabs, locally known as *alimasag* or *kasag*, make up an important part of fisheries production. In 2001, catches of crabs amounted to 36,973 t or 1.89% of the country's total marine production. The economic benefits from the blue crab resource are significant. In 2001, crabs ranked fifth in terms of export volume at 5,650 t and fourth in terms of value at PhP1.52 billion in export receipts. Crabs are processed and exported as fresh frozen, crab meat, soft shell crabs and, in the past three years, as live crabs. Most of the crab exports (over 80%) go to the US market while live crabs are exported mainly to Taiwan.

Exploited Crab Species

There are 51 species of swimming crabs reported in the country, but only about 7 are considered marketable. The blue crab, *Portunus pelagicus*, is the main species exploited, comprising over 90% of crab landings. The biology of the blue crab has been intensively studied (see Ingles 1988, 1992; Ingles and Braum 1989) due to its commercial importance in the Philippines. Other crab species landed and marketed include *Portunus sanguinolentus*, *Charybdis fereiata*, *C. natator*, *Scylla oceanica*, *S. serrata* and *Podopthalmus vigil*. Of recent development, small crabs belonging to the genera *Charybdis* and *Portunus* representing by-catch of small trawlers and Danish seines are sold in specialty restaurants. Other crab species are collected and consumed but do not go through normal market channels. These are species of the genus *Thalamita*. Gleaners collect these crabs in mangrove areas during low tide.

History of Landings

The blue crab fishery has been in existence since early times. Crabs were collected during low tide in the wide tidal flats fronting villages using simple gears such as spears or scoop nets. In shallow water areas, simple gears such as baited pots and crab liftnets were the only gears used.

Over the last 40 years, the trend in crab production followed the general pattern for many important target species in the Philippines. This was characterized by three phases (Figure 1): (1) a developing phase during 1961-1974 characterized by a gradual rise in production up to a level of 10,000 t; (2) a plateau during 1975-1991 when landings fluctuated between 10,000 and 20,000 t; and (3) a higher plateau during 1992 to the present when landings fluctuated between 25,000 and 40,000 t.

The type of fishing gears popular during a given phase influenced the catch levels. Thus, prior to the 1970s, only traditional (artisanal) gears exploited the crab resources. With the introduction and increased popularity of bottom trawls between the mid-1970s and mid-1980s, the crab resources were subjected to moderate to very severe exploitation by the commercial sector. This resulted in the doubling of catch that eventually led to decimation of crab resources in many

[1] This paper can be cited as follows: INGLES, J.A. 2004. Status of the blue crab fisheries in the Philippines, p. 47-52. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

trawlable areas of the country. The trawl ban in 1982 gave the blue crab resources a temporary reprieve from high-level exploitation. This reprieve was short-lived as there was a sudden demand for blue crabs starting in 1990 resulting from the collapse of the blue crab (*Callinectes sapidus*) fishery in Chesapeake Bay, USA. Production during the third phase was generated mainly by the artisanal fleet of crab gillnets and crab pots, fueled by the high export demand. Exports have increased five-fold in the last 10 years, with export value increasing rapidly in the last five years (Figure 2).

Major Fishing Grounds and Gears

The blue crab, *Portunus pelagicus*, is cosmopolitan in the country. This species prefer shallow water areas (up to 70 m depth) with sandy to muddy substrate (Ingles 1988). Areas with soft substrate and gentle slope are popular crabbing grounds. Over half (51.5%)

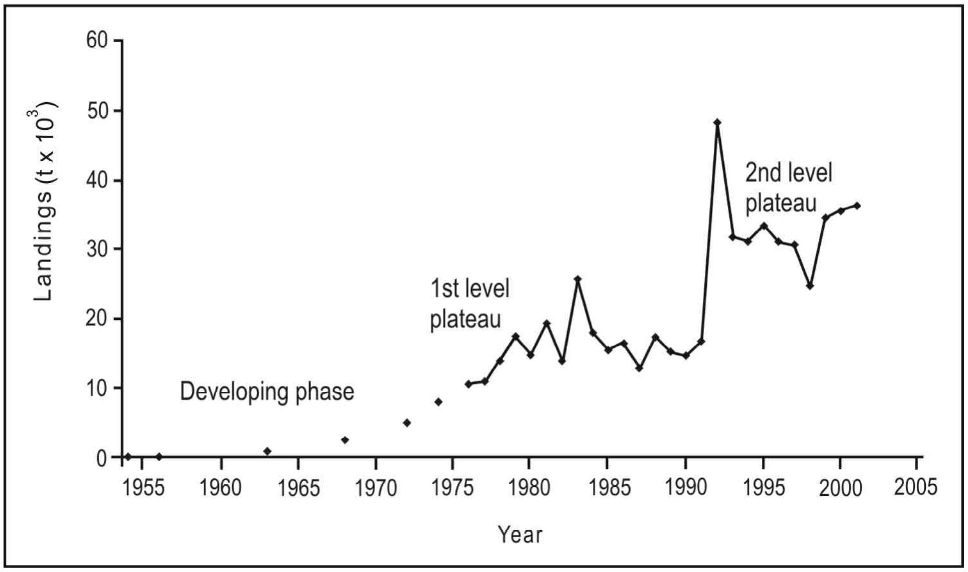


Figure 1. Historical production of blue crabs, *Portunus pelagicus* (BFAR 1961-1981 and BAS 1987-2001).

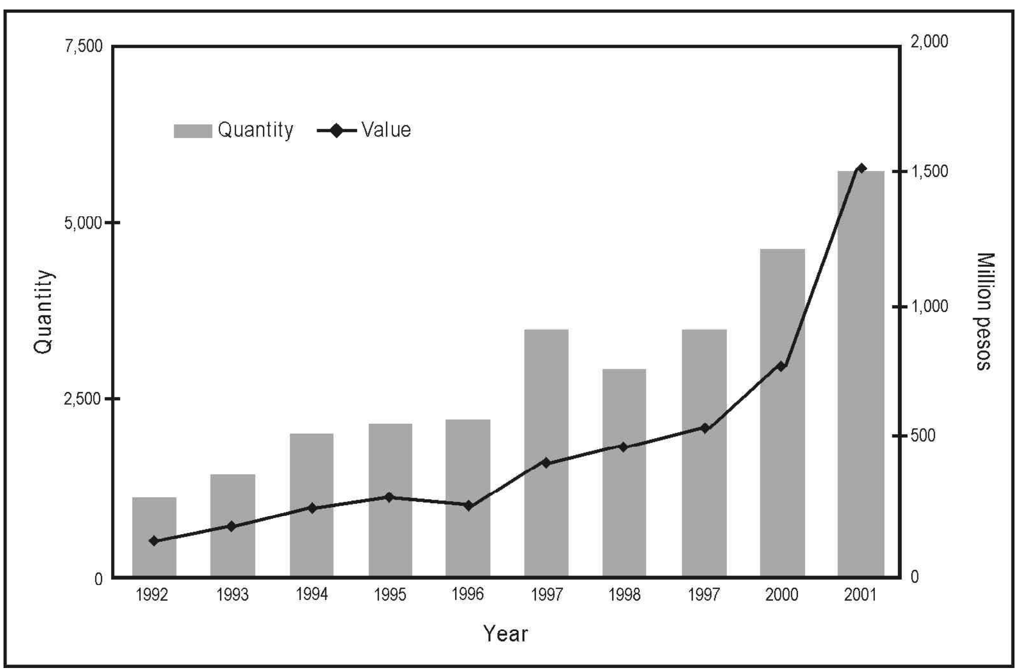


Figure 2. Quantity and value of crab exports of the Philippines (BAS 1987-2001).

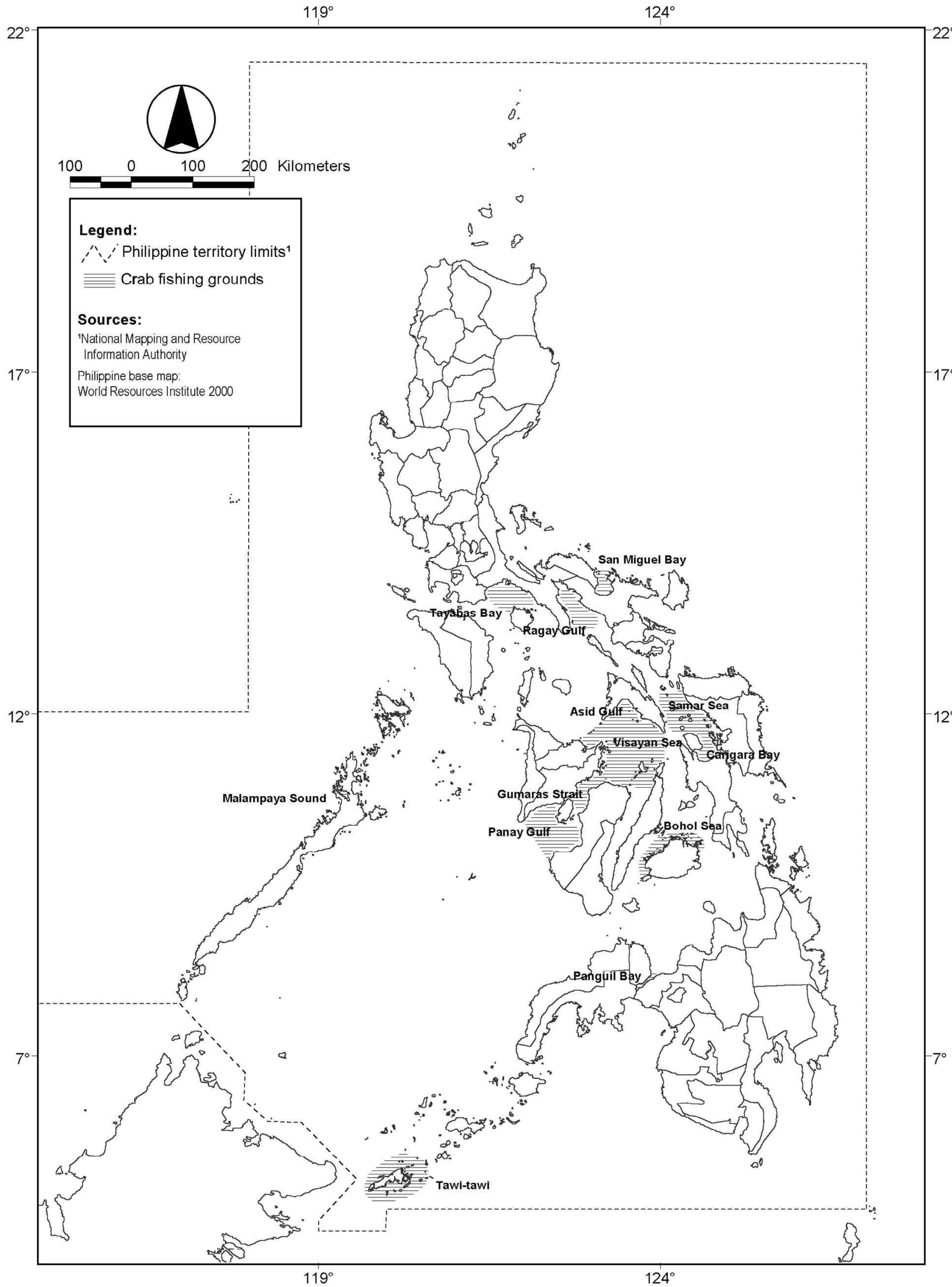


Figure 3. Major crab fishing grounds (shaded areas) in the Philippines.

of the blue crab production currently comes from Western Visayas (Visayan Sea and Guimaras Strait). The rest are from other parts of the country, specifically Asid Gulf, Bohol Sea, Samar Sea, Carigara Bay, Sorsogon Bay, northern part of Ragay Gulf, Tayabas Bay, Malampaya Sound and Panguil Bay. In Mindanao, crab fisheries exist in Panguil Bay and waters off Tawi-Tawi. Figure 3 shows the major crabbing grounds of the country.

Crabbing is a multigear fishery, i.e., crabs are caught and landed by different types of fishing gear. However, the major crab fishing gears are the entangling nets (popularly called crab gillnet) and the crab pot. The contribution of various fishing gears to crab production varies among fishing grounds. For instance, in the Visayan Sea and Guimaras Strait, the contributions of various gears are as follows: gillnets, 54.8%; crab pots, 22.2%; trawls and seines, 2.5%; and push nets, 20.5%. In Malampaya Sound where fishing is done solely by the artisanal sector, shares are as follows: gillnets, 95.0%; fish corrals, 2.5%; and push nets, 2.5%.

Exploitation Trends

The production of crabs over the last ten years fluctuates around 33,000 t. About 77% of the total production is exported. Crab fisheries in the Philippines show a boom and bust history. The huge demand for export triggers massive development of artisanal crab fisheries. In areas where crab meat processing plants are established, fishers are lured into crabbing because of high prices. The fisheries develop fully without any management intervention and would last until crab fishing becomes unprofitable. Then the processing plant or major buyers transfer operations to new areas to source raw materials. The whole process is repeated in different areas, such as in Malampaya Sound, Palawan, Visayan Sea and Guimaras Strait.

The maximum sustainable yield (MSY) for the Western Visayas crab fishery was estimated by Ingles (1996) to be about 1,300 t at a sustainable effort level (f_{MSY}) of about 13,150 gillnet panels (Figure 4). MSY was attained in 1993, just three years after the start of the full-blown fishery in 1990. Because of the absence of any regulatory policy to protect the resource, catch leveled off at around 1,000 t but effort continued to increase and in 1999 quadrupled to about 22,000 gillnet panels. This resulted in significant reduction in catch rates (Table 1). In Malampaya Sound, the same scenario was documented where catch rates declined to unprofitable levels (Ingles *et al.* 2002).

Table 1. Catch rates of blue crabs (kg/gillnet/day) over three different years in the Western Visayas crab fishery (Visayan Sea and Guimaras Strait). Values are not standardized for length of gillnets used (Ingles and Flores 2000).

Year/Month	August	September	October	Mean
1992	12.43	8.78	7.61	9.61
1998	7.73	7.12	7.43	7.43
1999	4.97	4.28	2.91	4.05

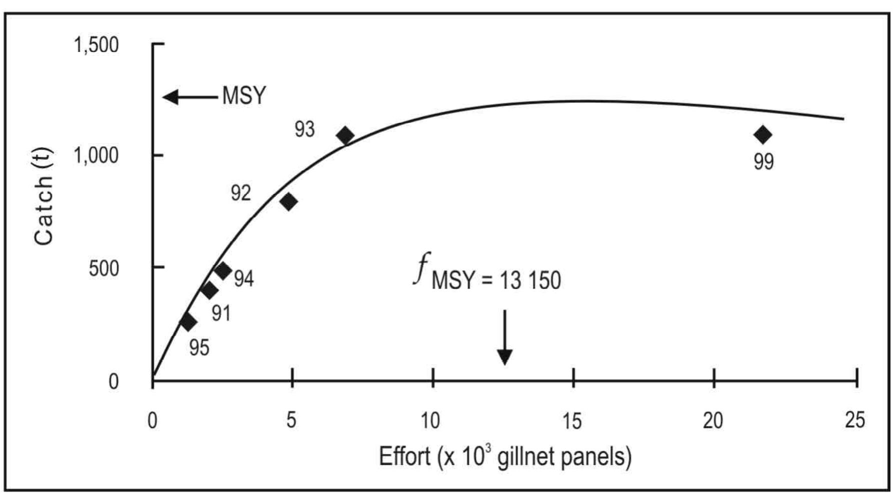


Figure 4. Estimates of MSY and f_{MSY} for the Western Visayas crab fishery (Ingles 1996).

Factors that Endanger the Resource Base

High by-catch

In a study by Ingles and Flores (2000), the by-catch of crab gillnets used in the Visayan Sea and Guimaras Strait reportedly accounted for 45% of the total catch. The by-catch consisted of brachyurans, univalve mollusks and fishes. Eighteen species of brachyurans were caught, of which 6 were marketable and 12 were simply killed and discarded, contributing immensely to biodiversity loss and possibly to ecosystem changes. For push nets which target shrimps, immature crabs with an average carapace width of 2.7 cm were caught and sold as “crablets” for specialized markets in Western Visayas.

Irresponsible fishing practices

Irresponsible fishing refers to fishing practices that are considered harmful to the ecosystem. Catches of crab gillnets and crab pots are significantly contaminated with immature individuals contributing to growth overfishing. About 28-34% of crab gillnet catches and 8-27% of crab pot catches consist of immature individuals. Similarly, berried (egg-bearing) females are landed by gillnets (21.8% of the catch) and crab pots (8.1%) contributing to recruitment overfishing.

The practice of killing and discarding the crab by-catch by gillnets and push nets results in a great loss to biodiversity. Another irresponsible practice is leaving crab gillnets soaked for three days. Very common in Malampaya Sound in Palawan and in highly depleted areas in the Visayan Sea, the gillnets are responsible for deaths of endangered dolphins in Malampaya Sound and wastage of other fish by-catch.

Lack of regulations

The high fishing pressure, reduced catch rates and declining production over the last five years in major fishing grounds such as Guimaras Strait, Visayan Sea and Malampaya Sound are ominous signs of overfishing. Lack of specific regulations to control effort increase and prevent growth and recruitment overfishing is a serious issue. Although previous attempts have been made, it was only lately (Jayme *et al.* 2003) that efforts to address the issue of sustainability of the crab resources have been pursued through initiatives by the World Wide Fund for Nature (WWF)-Philippines. Similar efforts are underway in Malampaya Sound to conserve the Irrawaddy dolphins through the reduction of crab gillnet-related mortality (Ingles *et al.* 2002).

Ghost fishing

The popularity of monofilament entangling gillnets has raised the issue of ghost fishing in Guimaras Strait and Visayan Sea. Estimates by Ingles and Flores (2000) showed that loss of gillnets due to incursions of trawlers in coastal fishing grounds amounted to 3,328 gillnet panels per year or about 166 gillnet units. This is equivalent to 24% of the total number of gillnets being used at the time of the study. The estimated loss of catch due to ghost fishing was placed at 311 t for blue crab resources alone.

Conclusion

Factors that endanger the resource base are closely interlinked and the main cause is the lack of specific management measures or regulations to protect the crab resources. To stop further deterioration, regulations are urgently needed to stop further increases in fishing effort and curb growth and recruitment overfishing. Initiatives toward this goal have been initiated by WWF-Philippines in key sites in Western Negros. Regulations to impose minimum capture size for crabs and a ban on sale and catching of immature crabs have considerably progressed at the local levels. Public hearings to make ordinances at the provincial level are underway. Even then, the scope of regulations should be expanded to effectively cover the geographic range of the resources.

The WWF-Philippines has likewise looked at the possibility of subjecting the blue crab resource to a marine stewardship certification process, which is a form of ecolabeling aimed at protecting the resource at all levels (catching, processing and to trade). Applying the concept but using a community-based approach was attempted, but deferred because of the rather stringent requirements (Romero *et al.* 2001; Jayme *et al.* 2003).

Given the boom and bust histories of crab fisheries, depletion of the resource determines the life span of the fishery. In all instances, resource demand drove the fishery to collapse. Market demand pushed prices higher allowing rent from fishing to be maintained at the cost of loss (or collapse) of the resource base. Overall, regulations must be put in place in order to protect the crab resources from overcapacity. A proactive stance and a long-term benefit perspective should be the guiding principles in instituting policies and regulations for the country’s crab fisheries (and any other fisheries for that matter).

References

BAS (Bureau of Agricultural Statistics). 1987-2001. Fisheries statistics of the Philippines. BAS, Quezon City, Philippines. Var. p.

BFAR (Bureau of Fisheries and Aquatic Resources). 1961-1981. Fisheries statistics of the Philippines. BFAR, Quezon City, Philippines. Var. p.

Ingles, J. 1988. Zur biologie und fischerei von *Portunus pelagicus* im Ragay Golf, Philippinen. University of Hamburg, Germany. 311 p. Ph.D. dissertation.

Ingles, J. 1992. Natural diet of the commercial blue swimming crab, *Portunus pelagicus*, in Ragay Gulf, Philippines, p. 69-83. *In* Proceedings of the First National Symposium in Marine Science, May 1990, Bolinao, Pangasinan. University of the Philippines-Marine Science Institute, Quezon City, Philippines.

Ingles, J. 1996. The crab fishery off Bantayan, Cebu, Philippines. Report submitted to the Philippine Council for Marine and Aquatic Resources Research and Development. Institute of Marine Fisheries and Oceanology, University of the Philippines-Visayas, Iloilo, Philippines. 34 p.

Ingles, J. and E. Braum. 1989. Reproduction and larval ecology of the blue swimming crab *Portunus pelagicus* in Ragay Gulf, Philippines. Int. Rev. Gesamt. Hydrobiol. 74: 471-490.

Ingles, J. and J. Flores. 2000. Addressing ecological impacts of fishing gears: A case study of the blue crab fishery of Guimaras Strait and Visayan Sea, Philippines, p. 382-387. *In* T. Arimoto (ed.) Proceedings of the Third Japan Society for the Promotion of Science-DGHE International Symposium on Fisheries Science in Tropical Areas, Bogor, Indonesia.

Ingles, J., G. Gacoba and L. del Valle. 2002. Aligning conservation with fisheries: A case study of the Irrawaddy dolphins in Malampaya Sound, Palawan, Philippines. Paper presented at the First National Capture Fisheries Symposium, 2-4 December 2002, Iloilo, Philippines.

Jayme, K., M. Romero and J. Ingles. 2003. Community-based certification of the blue crab fishery of Northeastern Guimaras Strait, Negros Occidental, Philippines: Lessons learned, prospects and directions. Paper presented at the Second International Tropical Marine Ecosystems Management Symposium, 24-27 March 2003, Manila, Philippines.

Romero, F., J. Ingles, K. Jayme, R. Apostol and J. Novy Hildesley. 2001. Prospects of community-based certification of the blue crab fishery in Negros Occidental, Philippines. World Wildlife Fund, Quezon City, Philippines. 15 p.

The Live Reef Food Fish Trade in the Philippines

SAMUEL MAMAUAG
International Marinelife Alliance-Philippines
PSSC Center, Commonwealth Ave.
Quezon City 1101
and
Marine Science Institute-University of the Philippines
Diliman, Quezon City 1101
Philippines

Introduction

The establishment of the live reef food fish trade (LRFFT) in the Philippines was brought about by the demand for live food fish initially from Hong Kong and Taiwan, and later on from mainland China (Barber and Pratt 1997). It is customary among Chinese consumers that fish should be kept live just before it is cooked, a belief said to ensure long-life among people. Barber and Pratt (1997) and Bentley (1999) reported that Hong Kong-based fishing vessels were observed operating near Philippine waters as early as the 1970s. Owing to their high economic value (see Sadovy and Vincent 2002), catches of live fish and other marine species have increased remarkably since the start of the LRFFT (FQS 1999). However, as in any harvested fishery resource, continuous increases in catches may lead to overexploitation, depletion of stocks, fishery collapse and serious ecological consequences (Russ 1991; Roberts 1995).

Fishing has several effects on fish populations and communities. Direct effects include decrease in abundance, density and biomass, and indirect effects include habitat modifications (Russ 1991). Reduction of abundance leads to biological complications, such as increased mortality rates, reduced body size and size/age at sexual maturity, and weak recruitment (Russ 1991).

Live food fish is conventionally caught using hook-and-line fishing gear. However, LRFFT has been closely associated with the problem of cyanide fishing, which was first detected in the aquarium trade (Barber and Pratt 1997). Robinson (1986) and Bentley (1999) revealed that some live fish collectors in the Philippines use varied amounts of sodium cyanide, a broad-spectrum poison used to temporarily stun fish during collection. Cyanide causes habitat degradation in coral reefs (Barber and Pratt 1997; Jones and Hoegh-Guldberg 1999; Burke *et al.* 2002) and even directly affects reef fishes (Rubec and Pratt 1984; Rubec 1988; Hall and Bellwood 1995). Degraded reefs take some time to recover (Aliño *et al.* 1985) and eventually result in habitat loss or alterations in reef communities like, for example, algal dominance (Hughes 1994). Furthermore, cyanide fishing is believed to be more efficient in catching live fish than the traditional hook and line (Robinson 1986), which renders the target species more susceptible to overexploitation.

State of LRFFT

LRFFT fishing sites

The LRFFT in the Philippines is widespread. Live food fish has been reported to come from at least 36 areas (Figure 1). At present, it is not known if most of these areas continue to generate landed catches of live fish. Few areas, however, remain well established in LRFFT. These areas include Coron, Guiuan, Surigao, Catanduanes, Camarines, Polillo Islands and Balabac (Figure 1). It is not very clear in which area LRFFT started in the Philippines. In the years of its monitoring and assessment, however, the International Marinelife Alliance (IMA) has gathered substantial amounts of information on the trade from two areas, Coron and Guiuan (Barber and Pratt 1997; Pratt *et al.* 2000). Coron

[1] This paper can be cited as follows: MAMAUAG, S. 2004. The live reef food fish trade in the Philippines, p. 53-59. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

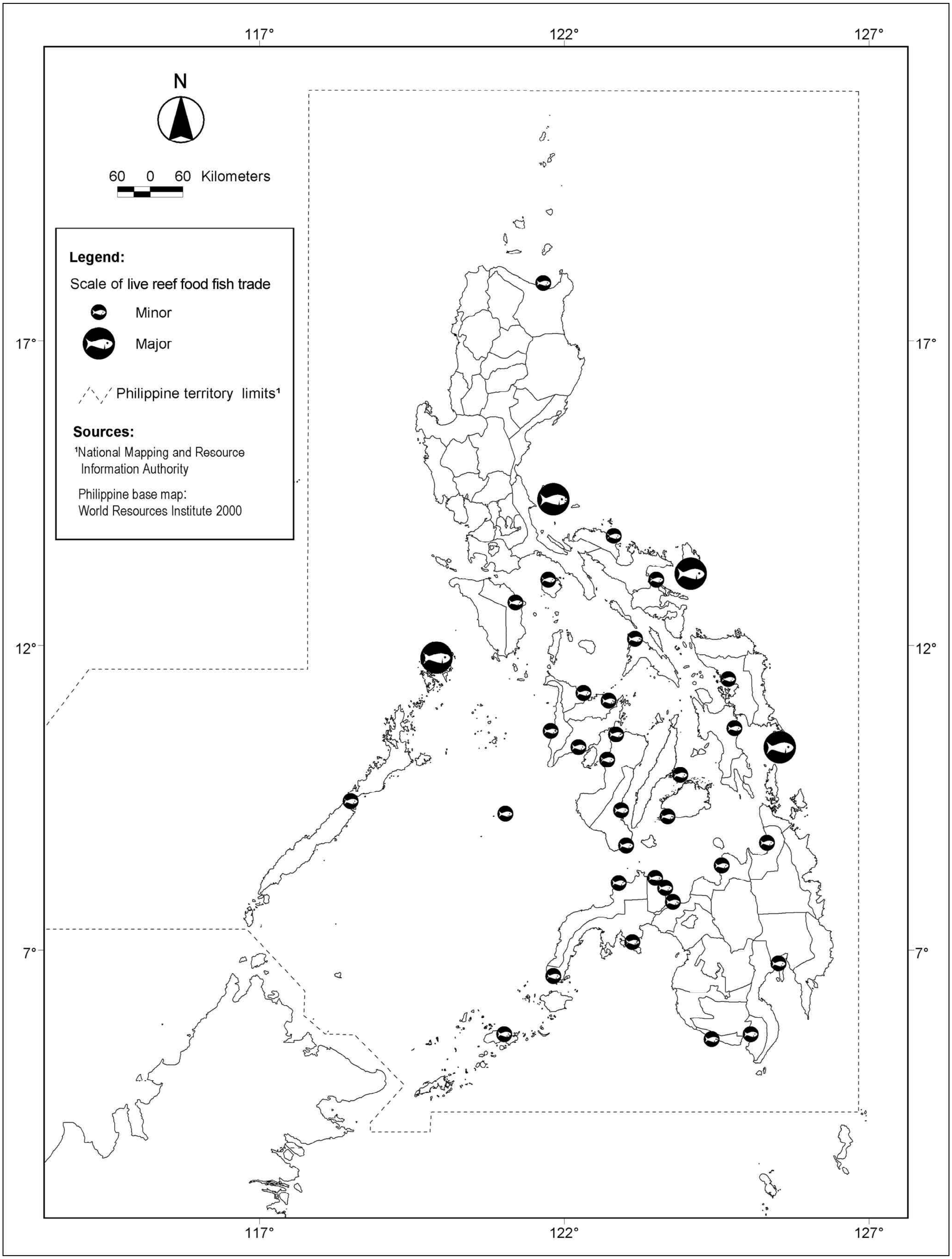


Figure 1. Major and minor LRFFT fishing areas in the Philippines.

or the Calamianes Group of Islands and Guiuan have more than 1,000 fishers each involved in the trade (Padilla *et al.*, in prep.; Bentley 1999). Other players in LRFFT include traders and exporters, which in Coron comprised about 10% of the total number of people involved in the trade (Padilla *et al.* in prep.).

Fishing gears

The most commonly used gear to collect live food fish is hook and line (Barber and Pratt 1997; Sadovy and Vincent 2002). Hook and line is used to harvest most large-sized grouper species. Traps are also used to collect adult as well as juvenile fish. Nets, which are generally used in the collection of aquarium fish, are also used particularly to capture Napoleon wrasse, *Cheilinus undulatus* (Sadovy and Vincent 2002).

Catch and export data

The LRFFT is a relatively new fishery in the Philippines. Data on total catch indicate a four-fold increase from about 200,000 kg in 1994 to 800,000 kg in 1997 (Figure 2). These data represent catches from all LRFFT fishing areas or sites (Figure 1). However, most data are fragmented and out-of-date; only those from Coron and Guiuan are relatively adequate and generally show recent declines (Figure 3).

Almost all live food fish harvested in the Philippines are exported, with only about 5% consumed locally (Pratt *et al.* 2000). Data on export of all live food fish species similarly declined from 1994 to 1999 (FQS 1999) (Figure 4).

Exploited species

In 1999, there were at least 24 species of marine vertebrates and invertebrates being harvested for LRFFT in the Philippines (Table 1) (Pratt *et al.* 2000). The leopard coralgrouper, *Plectropomus leopardus* (Figure 5), was the most dominant in the catch (Pratt *et al.* 2000). Like most groupers, *P. leopardus* is highly vulnerable to overexploitation due to its long life span, slow growth and low natural mortality rate (Ralston 1987), sequential hermaphroditism (Shapiro 1987), moderate-scale migration (Zellar 1998) and spawning behavior (Ferreira 1995; Samoilys 1997).

Table 1. List of species collected for LRFFT in the Philippines.

Species	Common Name
Family Serranidae	
Plectropomus leopardus	Leopard coralgrouper
Plectropomus areolatus	Squaretail coralgrouper
Plectropomus maculates	Spotted coralgrouper
Plectropomus laevis	Blacksaddled coralgrouper
Plectropomus oligacanthus	Highfin coralgrouper
Epinephelus bleekeri	Duskytail grouper
Epinephelus coioides	Orange-spotted grouper
Epinephelus malabaricus	Malabar grouper
Epinephelus fuscoguttatus	Brown-marbled grouper
Epinephelus polyphekadion	Camouflage grouper
Epinephelus fasciatus	Blacktip grouper
Epinephelus lanceolatus	Giant grouper
Epinephelus ongus	White-streaked grouper
Epinephelus cyanopodus	Speckled blue grouper
Cromileptes altivelis	Humpback grouper
Cephalopholis miniata	Coral hind
Anyperodon leucogrammicus	Slender grouper
Family Labridae	
Cheilinus undulates	Napoleon humphead wrasse
Family Siganidae	
Siganus guttatus	Spotted rabbitfish
Family Scaridae	
Scarus sp.	Parrotfish
Family Lutjanidae	
Lutjanus sebae	Red emperor
Family Scorpaenidae	
Synanceia sp.	Stonefish
Family Panuliridae	
Panulirus sp.	Lobster
Parribacus sp.	Flat lobster

Ecological Impacts of the Trade

Effects on fish size and age structure

Mean body size (total length) of *P. leopardus* in Coron decreased from about 31.5 cm in 1998 to about 30.1 cm in 2000. The reduction in fish body size is probably due to high fishing pressure in the area. Based on counts of annual rings in otoliths, the age range of *P. leopardus* catches in Coron was 2-8 years old, with a corresponding size range of 24-47 cm total length (Mamauag *et al.* 2002). Analyses of size frequency distributions of catches reveal that LRFFT in Coron and Guiuan has been targeting young, small and sexually immature and maturing individuals (Mamauag 1997). This poses threats of "recruitment overfishing", a phenomenon which results if fishing pressure is so high that it greatly affects recruitment (i.e., population replenishment) due to depletion of spawning adults (Russ 1991).

High exploitation levels on live fish, which are mostly composed of species of groupers, pose serious biological implications. Groupers, for which information is available, periodically aggregate to spawn en masse (Shapiro 1987; Samoilys 1997; Sadovy and Vincent 2002). Spawning aggregation is a form of behavior in fish reproduction (Warner 1984). Some aggregation sites in the Caribbean region have been

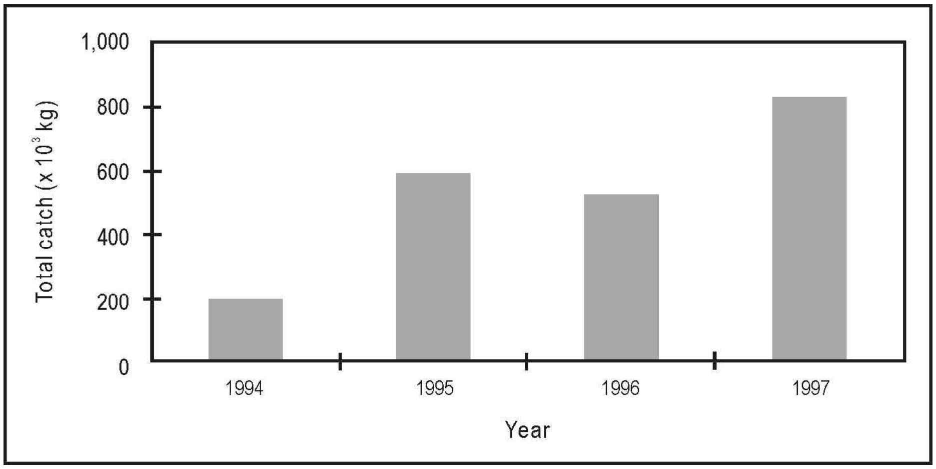


Figure 2. Estimated catch of live food fish species from LRFFT fishing areas in the Philippines, 1994-1997 (IMA-Philippines).

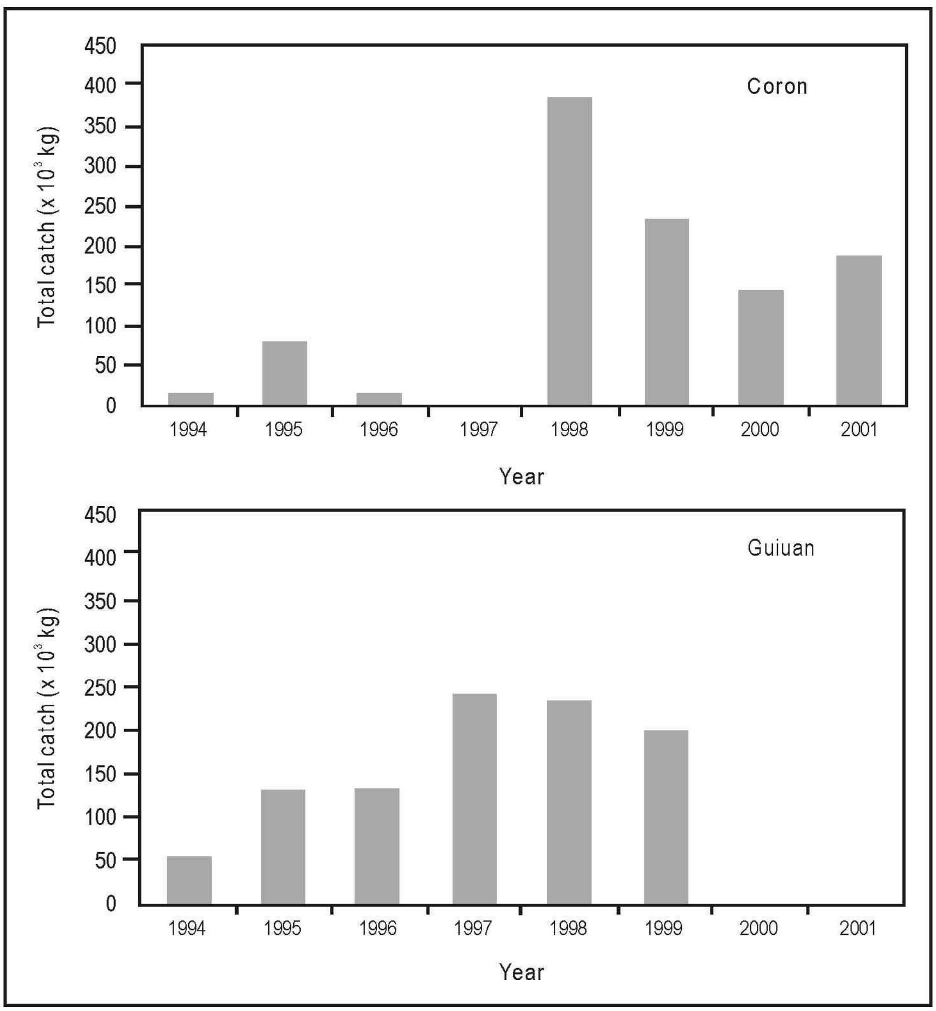


Figure 3. Total catch of live food fish from 1994 to 2001 in Coron and Guiuan.

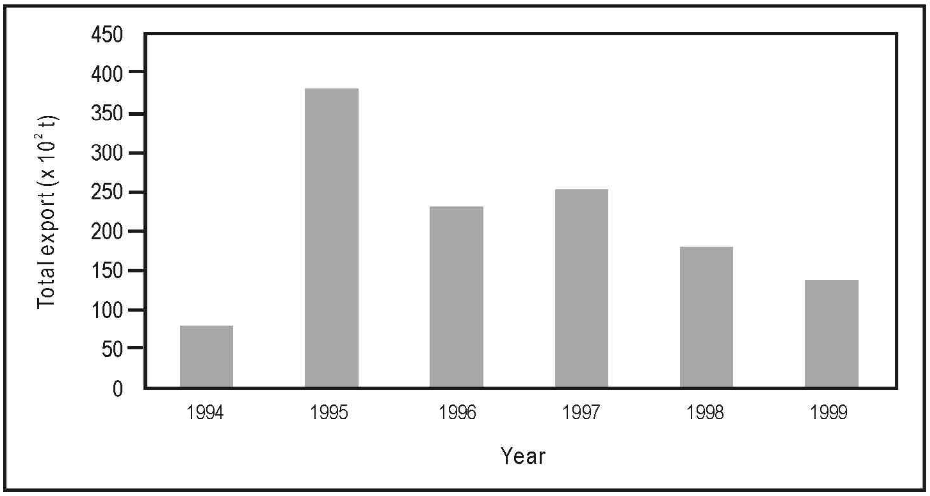


Figure 4. Export of live food fish and marine invertebrates, 1994-1999 (FQS 1999).

decimated largely due to high exploitation levels (Beets and Friedlander 1998). Sadovy and Vincent (2002) reported that some sites of spawning aggregation of groupers in Southeast Asia and the Pacific have been targeted by LRFFT.

Mortality and exploitation rate

Mortality rates based on aging of fish are key to determination of exploitation rates (Pauly 1984). Although preliminary, estimates of mortality and exploitation rate for *P. leopardus* exploited by LRFFT in Coron are available (see Mamauag *et al.* 2002). The total and fishing mortality estimates are 0.93 and 0.73, respectively, and imply a high exploitation rate of 0.78. These indicate that the stock of *P. leopardus* in Coron is overexploited.

Habitat effects

Following Mous *et al.* (2000), analysis of reef degradation presumably due to cyanide fishing has been made in Coron (see Padilla *et al.*, in prep.). The results indicate that even if cyanide was used for every fish caught, only a small portion of the total reef area in Coron would be degraded. Despite this finding, however, cyanide fishing remains a serious threat to the health of coral reefs. A comparison of percentage live and dead coral cover in cyanide-impacted and nonimpacted reefs in Coron supports this conclusion (Padilla *et al.*, in prep.). Live coral cover in nonimpacted sites was over 50%, compared to 5-40% in cyanide-impacted sites. This may imply that cyanide use leads to destruction of coral colonies (e.g., bleaching) most probably due to expulsion of symbiotic zooxanthellae (see Jones and Steven 1997; Jones and Hoegh-Guldberg 1999). Other factors, however, like increased sea surface temperature due to climate change (Arceo *et al.* 2001), blast fishing (Burke *et al.* 2002) and Crown-of-thorns infestation (Wilkinson 2000) may come into play and mask the effect of cyanide. Nevertheless, monitoring and enforcement of anti-cyanide ordinances should be strengthened in LRFFT fishing areas to reduce potential ecological impacts.

Figure 5. The leopard coralgrouper, *Plectropomus leopardus*, the most abundant species in LRFFT catch in the Philippines.

Improved Management of LRFFT

In 1994, IMA spearheaded the Destructive Fishing Reform Program that specifies a series of important reforms for LRFFT as well as the marine aquarium fish trade in the Philippines (Barber and Pratt 1997). These reforms include: (1) monitoring of the amount of live fish collected and exported from collection areas; (2) establishment of cyanide detection test laboratories to provide evidence of cyanide use; (3) provision of education and training for fishers and suspected cyanide users (so that they revert to cyanide-free and nondestructive methods of fish collection) while enhancing value-added sustainable production activities and local resource stewardship; (4) strengthening of the legal basis for regulating live fish trade by using cyanide detection test results as basis for regulation;(5) increasing enforcement levels and prosecution of cyanide users; (6) promoting reform of the live fish import policy; and (7) promoting public and official awareness about the far-reaching impacts of destructive fishing and fundamental solutions to this problem.

Despite these efforts, no management plans have been put in place for any LRFFT fishing area in the Philippines. The only reform implemented to reduce the impacts of the trade pertains to enforcement of anti-cyanide monitoring in selected fishing grounds like Coron. Although this is positive, the more pressing issue of overfishing has not been addressed. IMA is presently collaborating with the World Wildlife Fund-Philippines to carry out the latter's Sustainability Assessment Project. Ecological as well as economic and social assessments of LRFFT in Coron are being carried out for sustainability of the trade. Recommendations for improved management of LRFFT include reduction of fishing effort, catch control, size restriction, open/close fishery season vis-à-vis information on spawning season of *P. leopardus* in Coron and adjacent areas, and mariculture, among others. These are drawn up as part of advocacy work for the establishment of management plans for LRFFT in Coron. IMA is currently working on the assessment and creation of management plans for other LRFFT areas (e.g., Guiuan and Surigao), a move that is very timely in arresting the threats of fishery collapse, habitat degradation and huge economic losses in the other LRFFT areas in the country.

References

Aliño, P.M., P. Banzon, H. Yap, E. Gomez, J. Morales and R. Bayoneto. 1985. Recovery and recolonization on a damaged backreef area at Cangaluyan Island. Proc. Fifth Int. Coral Reef Symp.: 279-284.

Arceo, H., M. Quibilan, P. Aliño, G. Lim and W. Licuanan. 2001. Coral bleaching in Philippine reefs: Coincident evidences with mesoscale thermal anomalies. Bull. Mar. Sci. 69(2): 579-593.

Barber, C. and V. Pratt. 1997. Sullied seas: Strategies for combating cyanide fishing in Southeast Asia and beyond. World Resources Institute Report, 64 p. Washington, DC, USA.

Beets, J. and A. Friedlander. 1998. Stock analysis and management strategies for red hind *Epinephelus guttatus*, in the US Virgin Islands. Proc. Gulf Caribb. Fish. Inst. 42: 66-79.

Bentley, N. 1999. Fishing for solutions: Can the live trade in wild groupers and wrasses from Southeast Asia be managed? TRAFFIC Southeast Asia, Petaling Jaya, Malaysia.

Burke, L., E. Selig and M. Spalding. 2002. Reefs at risk in Southeast Asia. World Resources Institute, Washington, DC, USA.

Ferreira, B.1995. Reproduction of the common coral trout *Plectropomus leopardus* (Serranidae: Epinephelinae) from the central and northern Great Barrier Reef, Australia. Bull. Mar. Sci. 56(2): 653-669.

FQS (Fisheries Quarantine Service). 1999. Data on live fish trade export from shipment records. FQS, Bureau of Fisheries and Aquatic Resources, Department of Agriculture, Pasay City, Philippines.

Hall, K. and D. Bellwood. 1995. Histological effects of cyanide, stress and starvation on the intestinal mucosa of *Pomacentrus coelestis*, a marine aquarium fish species. J. Fish Biol. 47: 438-454.

Hughes, T. 1994. Catastrophies, phase shifts and large scale degradation of a Caribbean coral reef. Science 265:1547-1551.

Jones, R. and A. Steven. 1997. Effects of cyanide on corals in relation to cyanide fishing on reefs. Mar. Freshwat. Res. 48: 517-522.

Jones, R. and O. Hoegh-Guldberg. 1999. Effects of cyanide on coral photosynthesis: Implications for identifying the cause of coral bleaching and for assessing the environmental effects of cyanide fishing. Mar. Ecol. Prog. Ser. 177: 83-91.

Mamauag, S. 1997. Age, growth and reproduction of *Plectropomus* spp. (Serranidae: Epinephelinae) in Northern Palawan, Philippines. Department of Marine Biology, James Cook University, Queensland, Australia. M.S. thesis.

Mamauag, S., T. Donaldson, V. Pratt and B. McCullough. 2002. Age and size structure of the leopard coralgrouper, *Plectropomus leopardus* (Serranidae: Epinephelinae) in the live reef fish trade of the Philippines. Proc. Ninth Int. Coral Reef Symp. 2: 649-655.

Mous, P., L. Pet-Soede, M. Erdmann, H. Cesar, Y. Sadovy and J. Pet. 2000. Cyanide fishing on Indonesian coral reefs for the live food fish market – what is the problem? *In* H. Cesar (ed.) Collected essays on the economics of coral reefs. CORDIO, Kalmar University, Sweden. 244 p.

Padilla, J., S. Mamauag, G. Braganza, D. Yu and N. Brucal. (In prep.). Sustainability assessment of the live reef food fish trade in the Philippines. Draft report of the Southeast Asia Policy Project of the World Wildlife Fund.

Pauly, D. 1984. Fish population dynamics in tropical waters: A manual for use with programmable calculators. ICLARM Stud. Rev. 8, 325 p.

Pratt, V., S. Mamauag, J. Alban, E. Parfan and T. Donaldson. 2000. Status report on the Philippine live reef fish trade and strategies to combat its destructive fishing practices. Marine Science Institute-University of the Philippines, Quezon City, Philippines.

Ralston, S. 1987. Mortality rates of snappers and groupers. *In* J.J. Polovina and S. Ralston (eds.) Tropical snappers and groupers: Biology and fisheries management. Westview Press, Colorado, USA. 659 p.

Roberts, C. 1995. Effects of fishing on the ecosystem structure of coral reefs. Conserv. Biol. 9(5): 988-995.

Robinson, S. 1986. Palawan's live *lapu-lapu/mameng* trade: Raising the stakes in the cyanide controversy. Report submitted to the Task Force on Illegal Fishing, Ministry of Agriculture, Manila, Philippines.

Rubec, P. 1988. The need for conservation and management of Philippine coral reefs. Environ. Biol. Fish. 23(1-2): 141-154.

Rubec, P. and V. Pratt. 1984. Scientific data concerning the effects of cyanide on marine fish. Freshwat. Mar. Aquar. 7(5): 4-6, 78-80, 82-86, 90-91.

Russ, G.R. 1991. Coral reef fisheries: Effects and yields, p. 601-635. *In* P.F. Sale (ed.) The ecology of fishes on coral reefs. Academic Press, New York, USA. 754 p.

Sadovy, Y. and A. Vincent. 2002. Ecological issues and the trades in live reef fishes. *In* P.F. Sale (ed.) Coral reef fishes: Dynamics and diversity in a complex ecosystem. Academic Press, California, USA. 549 p.

Samoilys, M. 1997. Periodicity of spawning aggregations of coral trout *Plectropomus leopardus* (Pisces: Serranidae) on the northern Great Barrier Reef. Mar. Ecol. Prog. Ser. 160: 149-159.

Shapiro, D. 1987. Reproduction in groupers. *In* J.J. Polovina and S. Ralston (eds.) Tropical snappers and groupers: Biology and fisheries management. Westview Press, Colorado, USA. 659 p.

Warner, R. 1984. The adaptive significance of sequential hermaphroditism in animals. Am. Nat. 109: 61-82.

Wilkinson, C. 2000. Status of coral reefs of the world: 2000. Australian Institute of Marine Science, Australia. 127 p.

Zellar, D. 1998. Spawning aggregations: Patterns of movement of the coral trout *Plectropomus leopardus* (Serranidae) as determined by ultrasonic telemetry. Mar. Ecol. Prog. Ser. 162: 253-263.

Status of the Philippine Marine Aquarium Fish Trade[1]

DOMINGO OCHAVILLO
GREGOR HODGSON
CRAIG SHUMAN
RENANTE RUZ
Reef Check, Institute of the Environment, 1652 Hershey Hall
University of California in Los Angeles
Los Angeles, California, 90095-1496
USA

Background

The marine aquarium or ornamental fish trade is a relatively recent development (most fisheries starting just after World War II). It is highly selective and involves harvesting many targeted coral reef fish and invertebrate species. Moreover, it is a high value-to-volume industry involving resources that are valued for their aesthetic appeal rather than nutritional importance. Virtually all marine ornamental fishes are collected from the wild, with only a very small proportion from hatcheries (Warmolts 2000; Wood 2001). Capture methods include a combination of barrier and scoop nets alone or with hookah (surface-supplied compressed air) and presumably chemicals such as cyanide and native plant products. About 386 fish species from 79 families are currently traded from the Philippines (Vallejo 1997) (Table 1). Most traded fishes come from only a few families (Conroy 1975; Randall 1987; Sadovy 1992; Pyle 1993; Rajasuriya *et al.* 1995; Wood 2001). The global marine aquarium industry trades an estimated 15 to 36 million marine fishes annually with a value between $90 and $300[2] million (Wheeler 1996; Biffar 1997; Warmolts 2000). This is separate from the aquarium products industry which alone is valued at $300 million annually (Baquero 1999). The marine aquarium fish exports of the Philippines were about P300 million in 2001 (Table 2).

The Philippines and Indonesia are the major sources of marine ornamentals. The Philippines started its own ornamental trade in the 1950s (McAllister *et al.* 1999). The major source areas of ornamentals in the Philippines are Cebu, Bohol, Bataan, Batangas, Davao, Zambales and Palawan (Albaladejo and Corpuz 1981).

Table 1. Species comprising the bulk of catches for the marine aquarium fish trade in the Philippines.

Species	Common Name
Dascyllus aruanus	Three-striped humbug
Dascyllus reticulatus	Reticulated damselfish
Dascyllus trimaculatus	Domino damselfish
Dascyllus melanurus	Blacktail damselfish
Chromis viridis	Blue-green chromis
Chrysiptera parasema	Yellowtail blue damselfish
Neoglyphidodon nigroris	Blackmouth damselfish
Neoglyphidodon melas	Blue-finned damselfish
Pterois volitans	Black peacock
Zanclus cornutus	Moorish idol
Plectorhinchus chaetodonoides	Harlequin sweetlips
Zebrasoma veliferum	Sailfin tang
Labroides dimidiatus	Cleaner wrasse
Centropyge vroliki	Half-black angelfish
Pygoplites diacanthus	Regal angelfish
Pomacanthus imperator	Emperor angelfish
Pomacanthus sextriatus	Six-banded angelfish
Pomacanthus semicirculatus	Blue koran
Chaetodontoplus mesoleucus	Vermiculated angelfish
Chelmon rostratus	Chelmon butterflyfish
Chaetodon punctatofasciatus	Punctato butterflyfish
Chaetodon octofasciatus	Eight-banded butterflyfish
Amphiprion frenatus	Tomato clownfish
Amphiprion ocellaris	False percula clownfish
Amphiprion clarkii	African clownfish
Amphiprion perideraion	Pink skunk anemonefish
Amphiprion sandaracinos	Orange skunk anemonefish
Premnas biaculeatus	Maroon clownfish

The major destinations of the trade are Europe and USA (Sadovy and Vincent 2002), although the Asian market is also rapidly expanding. The hobby trade accounts for 99% of the imported marine fishes and invertebrates, while public aquaria take up the rest.

[1] This paper can be cited as follows: OCHAVILLO, D., G. HODGSON, C. SHUMAN and R. RUZ. 2004. Status of the Philippine marine aquarium fish trade, p. 60-64. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] All $ amounts are US$.

Figure 1. Fishers catching aquarium fish.

The aquarium trade involves extremely selective coral reef fisheries (Figure 1). There is a high premium for rare species, very specific size ranges and uncommon color forms of target species. Hobbyists prefer fish sizes from 2 to 10 cm, since smaller and larger individuals are difficult to maintain in home aquaria (Chan and Sadovy 1998; Wood 2001). Smaller individuals are also preferred by traders because larger individuals are more expensive to transport (in terms of number of fish shipped per unit transport volume). Attractive and unusual coloration is a major value factor. There is a preference for juveniles, certain sexes of fish species, uncommon color forms and unusual hybrids (Sadovy *et al.* 2001; Wood 2001; Sadovy and Vincent 2002).

Socioeconomic and Ecological Issues

Levels of collection and trade data are generally poor, especially from countries of origin. If the quality of data of Philippine marine fisheries is generally bad, the aquarium trade's is even worse (see Table 2). Export data are basically inaccessible because of taxation implications. This is exacerbated by the high rates of mortality during capture, holding and transport, prior to export (Johannes and Lam 1999). Therefore, any estimate of extraction rate at this point is a gross underestimate.

An estimated 70% of ornamental fishes from the Philippines are caught with cyanide that is used to stun target species before capture (Hingco and Rivera 1991; Barber and Pratt 1997; Bentley 1999). This chemical, however, degrades rapidly so that current technology used in testing its presence in captured fishes is unreliable (Barber and Pratt 1997; McAllister *et al.* 1999). Despite its notoriety, there is little research on the long-term effects of cyanide on coral reefs (Mous *et al.* 2000). Short-term effects, however, include inhibiting coral growth (Jones and Hoegh-Guldberg 1999) that has implications on reef habitat preservation.

Post-capture mortality of ornamental fishes can range from a few percent to a high of 80% (Hall and Bellwood 1995; Hanawa *et al.* 1998). For instance, collected fish may be held in plastic bags with infrequent water changes and/or changes with polluted water. In some cases, their transport is delayed due to poor collector-exporter coordination. These translate into increased fishing pressure due to replacement purchases by hobbyists.

There is almost no research on the impacts of the ornamental trade on coral reef ecosystems despite the attendant socioeconomic conditions that are the ingredients for overexploitation. The populations of resource users are rapidly expanding in a fishery that has low investment and opportunity costs. The present trade structure (e.g., numerous middlepersons) can directly (via supply of cyanide) or indirectly promote destructive fishing practices (Perino 1990). High hidden and unrecorded mortalities coupled with inaccessible and unreliable trade figures underestimate exploitation rates.

Because it is a highly selective fishery, there is potential for "growth" and "ecosystem" overfishing. Immature fishes are often targeted and can be more valuable than larger fishes. This can lead to decreased number of older fish individuals. It has also often been suggested that coral reef fishes may be more vulnerable to overexploitation compared to many other fishes (Russ 1991). They are usually restricted to the reef environment and have small home ranges and limited habitat and depth preferences (Munro and Williams 1985).

There has been no concrete documentation on the magnitude of impact of the ornamental trade on populations of target species. Only the studies made by Tissot and Hallacher (1999) established more concretely the negative impact of collection on target populations. All of the 10 species they examined showed significant decline in densities presumably due to aquarium fish collection.

Selective removal of target species is expected to cause changes in the community structure of reef fishes (Pauly 1979; Hay 1984; Pauly 1988; Koslow *et al.* 1988; Russ and Alcala 1989; Russ 1991). Indeed, there may be some indications that growth and ecosystem overfishing is happening in some reefs in the Philippines with a long history of ornamental species collection. In a recent investigation of the impacts of aquarium trade on some Philippine reefs, Ochavillo *et al.* (in prep.) found that some targeted species have lower abundance in collection sites in the Palawan and Cebu-Bohol areas. There is an indication of growth overfishing of the heavily exploited *Dascyllus aruanus* in these sites. Exploitation rate is beyond sustainable levels, with low investment costs and the price premium for rarity threatening to further aggravate the situation. Results of this study also indicate changes in the community structure of fishes in the Cebu-Bohol and Coron areas.

Management Needs

The ecological integrity of the coral reef ecosystem and socioeconomic integrity of the collectors' community should be the goal of management. Management initiatives to sustain the ornamental trade, therefore, should be comprehensive, integrative and adaptive taking into account both the resources and the users. Populations of target species need to be maintained at sustainable levels both to ensure a healthy coral reef ecosystem and provide a source of income for fishing communities.

Table. 2. Value of marine aquarium fish exports of the Philippines, 1970-2001 (BFAR 1979-1987; 1993-2001). Data prior to 1993 may include combined aquarium and live reef food fish trade figures.

Year	Value (P)	% of Philippine Fisheries Exports
1970	1,000,263	-
1971	1,693,366	-
1972	3,289,262	-
1973	5,738,062	-
1974	6,304,677	-
1975	10,504,620	-
1976	14,417,636	-
1977	15,980,607	-
1978	17,330,285	-
1979	20,367,969	2.6
1980	22,703,511	2.4
1981	23,502,558	1.9
1982	23,774,196	2.1
1983	36,128,830	2.3
1984	50,615,967	2.3
1985	77,924,438	2.2
1986	84,225,757	1.7
1987	107,206,408	1.7
1993	199,917,000	1.4
1994	213,328,000	1.4
1995	226,996,000	1.4
1996	200,257,000	1.3
1997	214,261,000	1.3
1998	248,041,000	1.2
1999	260,919,000	1.3
2000	271,580,000	1.3
2001	320,500,000	1.4

Ecological research and monitoring

There is obviously a need to understand the population biology of target species in collection and noncollection sites, and to determine their rates of harvest from coral reefs. Information that needs to be collected includes species' biology aspects, such as reproduction, recruitment and mortality rates, as well as their interconnectedness with other populations. Data on these are critical in understanding how target populations behave with varying exploitation levels.

Information on fishing effort, trade data and mortalities (from point of harvest to retail store) for target species is also helpful in formulating management measures. At present, these are unrecorded and/or inaccessible. On a smaller scale, there might be a need to rotate collection pressure among sites within areas known to engage in ornamental collection. However, the recovery period should be adequately worked out. On a larger scale, data on area catch rates per species can be used to divert trade demands to areas with relatively higher catch rates.

Local communities should also be trained to survey or monitor their resources. In this way, they can have a sense of stewardship for them.

Catch limits and closed seasons

There might be a need to impose size and catch limits on juveniles to avoid growth overfishing. Outright bans might be imposed on the collection and trade of shark eggs and juveniles since these fishes have very low fecundity. Species that are hard to maintain even with the best collection and maintenance practices and/or those with densities much lower than pristine levels might also be banned from the trade. Closed seasons might be imposed during reproductive periods of target populations.

Improving capture, handling, transport and maintenance practices

There is a need to increase collectors' awareness on the potential, long-term negative effects of cyanide. Improvements need to be made in these areas: capture methods and the quality of holding facilities and practices (Johannes and Riepen 1995; Bentley 1999); trade operations (from collection to export), to avoid lengthy holding periods that can result in massive mortalities; and the structure of the trade (e.g.

empowering local collectors' cooperatives), to reduce the number of middlepersons. Investments should also be increased in research and mariculture of target species to reduce pressure on wild populations.

Establishment of marine protected areas

There is a need to establish marine protected areas (MPAs) that include "no-take" zones (Salm *et al.* 2000) to act as shelters of breeding stocks and larval sources. Establishing these is a simpler management initiative but involves complex issues (Salm *et al.* 2000) that include site selection, optimal size and design, and other larger issues of management, enforcement and monitoring. Collectors should be engaged in all aspects of MPA design. Economic valuation that incorporates prices and biological parameters of target species (such as recruitment, growth and mortality) can be used to show the long-term benefits of MPAs.

Active intervention for stock recovery

There might be a need for active intervention to speed up recovery of populations to their natural levels through restocking of MPAs and collection sites. Fishes that have lost some scales or have sustained other forms of injury are usually rejected because they have low aesthetic value. These rejects can be reseeded in collection sites and MPAs. Precluding mortality due to injury, these fishes have potential as additional breeding stocks. However, there is a need to collect data on the survival and growth rates of these reseeded fishes.

The Marine Aquarium Council

An outright ban on the aquarium trade is counterproductive at this point. It is an economically important industry. The prospects of better resource management are also considerably brighter than those of many other fisheries. There is a relatively higher level of environmental awareness in the ornamental trade market. Hobbyists prefer getting fishes from areas where animals are collected, handled and managed well. This is a positive aspect of the trade that promotes better practices. This implies that trade legislation controlling transport and avoiding destructive practices may be relatively easier to impose. The Marine Aquarium Council is currently promoting the certification of collection areas and all levels of the trade based on numerous criteria of best practices. This includes the formulation of collectors' area management plans and emphasizing the traceability of organisms caught from reef to retail. This is expected to improve fishing effort, mortality and trade data from collectors, middlepersons, exporters and importers. There might also be a need to license collectors to discourage poaching in other areas. Hopefully, these initiatives can lead to sustainability of an important biological and economic resource of many fishing communities.

References

Albaladejo, V.D. and V.T. Corpuz. 1981. A market study of the aquarium fish industry of the Philippines: An assessment of the growth and the mechanics of the trade. Proc. Fourth Int. Coral Reef Symp. 1: 75-81.

Baquero, J. 1999. Marine ornamentals trade: Quality and sustainability for the Pacific region report. South Pacific Forum Secretariat, Suva, Fiji.

Barber, C.Y. and V.R. Pratt. 1997. Sullied seas: Strategies for combating cyanide fishing in Southeast Asia and beyond. World Resources Institute and International Marinelife Alliance, Manila, Philippines/Washington, DC, USA.

Bentley, N. 1999. Fishing for solutions: Can the live trade in wild groupers and wrasses from Southeast Asia be managed? TRAFFIC Southeast Asia, Petaling Jaya, Malaysia.

BFAR (Bureau of Fisheries and Aquatic Resources). 1979-1987. Fisheries statistics of the Philippines. Vols. 29-37. BFAR, Quezon City, Philippines. Var. pages.

BFAR (Bureau of Fisheries and Aquatic Resources). 1993-2001. Philippine fisheries profile. BFAR, Quezon City, Philippines. Var. pages.

Biffar, M. 1997. The worldwide trade in ornamental fish: Current status, trends and problems. Bull. Eur. Assoc. Fish Pathol. 17: 201-204.

Chan, T.T.C. and Y. Sadovy. 1998. Profile of the marine aquarium fish trade in Hong Kong. Aquar. Sci. Conserv. 2: 1-17.

Conroy, D.A. 1975. An evaluation of the present state of world trade in ornamental fish. Food and Agriculture Organization, Rome, Italy, and Inland Water Fishery Development Programme, Bogota, Colombia.

Hall, K.C. and D.R. Bellwood. 1995. Histological effects of cyanide, stress and starvation on the intestinal mucosa of *Pomacentrus coelestis*, a marine aquarium fish species. J. Fish. Biol. 47: 438-454.

Hanawa, M., L. Harris, M. Graham, A.P. Farrell and L.I. Bendell-Young. 1998. Effects of cyanide exposure on *Dascyllus aruanus,* a tropical marine fish species: Lethality, anaesthesia and physiological effects. Aquar. Sci. Conserv. 2: 21-34.

Hay, M.E. 1984. Patterns of fish and urchin grazing on Caribbean coral reefs: Are previous results typical? Ecology 65: 446-454.

Hingco, T.G. and R. Rivera. 1991. Aquarium fish industry in the Philippines: Towards development or destruction?, p. 249-253. *In* L.M. Chou, T.E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong (eds.) Towards an integrated management of tropical coastal resources. ICLARM Conf. Proc. 22, 455 p.

Johannes, R.E. and M. Lam. 1999. The live reef food fish trade in the Solomon Islands. Secretariat of the Pacific Community Live Reef Fish Inf. Bull. 5: 8-15.

Johannes, R.E. and M. Reipen. 1995. Environmental, economic, and social implications of the live reef fish trade in Asia and Western Pacific. Report to The Nature Conservancy and the Forum Fisheries Agency.

Jones, R.J. and O. Hoegh-Gulberg. 1999. Effects of cyanide on coral photosynthesis: Implications for identifying the cause of coral bleaching and for assessing the environmental effects of cyanide fishing. Mar. Ecol. Prog. Ser. 177: 83-91.

Koslow, J.A., F. Hanley and R. Wicklund. 1988. Effects of fishing on reef fish communities at Pedro Bank and Port Royal Cays, Jamaica. Mar. Ecol. Prog. Ser. 43: 201-221.

McAllister, D.E., E. Caho and C.T. Shih. 1999. Cyanide fisheries: Where did they start? Secretariat of the Pacific Community Live Reef Fish Inf. Bull. 5: 18-21.

Mous, P.J., L. Pet-Soede, M. Erdmann, H. Cesar, Y. Sadovy and J.S. Pet. 2000. Cyanide fishing on Indonesian coral reefs for live food fish market: What is the problem? Secretariat of the Pacific Community Live Reef Fish Inf. Bull. 7:20-26.

Munro, J.L. and D.M. Williams. 1985. Assessment and management of coral reef fisheries: Biological, environmental and socioeconomic aspects. Proc. Fifth Int. Coral Reef Cong. 4: 545-581.

Ochavillo, D.G., G. Hodgson, C. Shuman and R. Ruz. Fish density decline and community changes in ornamental collection reef sites in the Philippines. (In prep.).

Pauly, D. 1979. Theory and management of tropical multispecies stocks: A review with emphasis on the Southeast Asian demersal fisheries. ICLARM Stud. Rev. 1, 35 p.

Pauly, D. 1988. Some definitions of overfishing relevant to coastal management in Southeast Asia. Trop. Coast. Area Manage. 3: 14-15.

Perino, L. 1990. Assessment of the feasibility of establishing an aquarium fish industry in Papua New Guinea. South Pacific Forum Fisheries Agency. FFA Rep. 90/30.

Pyle, R.L. 1993. Marine aquarium fish, p. 135-176. *In* A. Wright and L. Hill (eds.) Nearshore marine resources of the South Pacific. Forum Fisheries Agency, Honiara, Solomon Islands.

Rajasuriya, A., R.M. De Silva and M.C. Ohman. 1995. Coral reefs of Sri Lanka: Human disturbance and management issues. Ambio 24: 428-437.

Randall, J.E. 1987. Collecting reef fishes for aquaria, p.29-38. *In* B. Salvat (ed.) Human impacts on coral reefs: Facts and recommendations. Antenne Museum, EPHE, French Polynesia.

Russ, G.R. 1991. Coral reef fisheries: Effects and yields, p. 601-634. *In* P.F. Sale (ed.) The ecology of fishes on coral reefs. Academic Press, San Diego, California. 754 p.

Russ, G.R. and A. Alcala. 1989. Effects of intense fishing pressure on an assemblage of coral reef fishes. Mar. Ecol. Prog. Ser. 56: 13-27.

Sadovy, Y. 1992. A preliminary assessment of the marine aquarium export trade in Puerto Rico. Proc. Seventh Int. Coral Reef Symp.: 1014-1022.

Sadovy, Y.J. and A.C.J. Vincent. 2002. Ecological issues and the trades in live reef fishes, p. 391-420. *In* P.F. Sale (ed.) Coral reef fishes: Dynamics and diversity in a complex ecosystem. Academic Press, California, USA.

Sadovy, Y., G. Mitcheson and M.B. Rasotto. 2001. Early development of the mandarinfish, *Synchiropus splendidus* (Callionymidae) with notes on its fishery and potential for culture. Aquar. Sci. Conserv. 3: 253-263.

Salm, R.V., J. Clark and E. Siirila. 2000. Marine and coastal protected areas: A guide for planners and managers. World Conservation Union (IUCN), Washington, DC, USA. 371 p.

Tissot, B.N. and L.E. Hallacher. 1999. Impacts of aquarium collectors on coral reef fishes in Kona, Hawaii. Tech. Rep. Division of Aquatic Resources, Department of Land and Natural Resources, Hawaii, USA.

Vallejo, B.V. 1997. Survey and review of the Philippine marine aquarium fish industry. Sea Wind 11: 2-16.

Warmolts, D.I. 2000. Marine medicinals in the aquarium trade, p. 107-109. *In* M.A. Moreau, M.J. Hall and A.C.J. Vincent (eds.) Workshop on the Management and Culture of Marine Species Used in Traditional Medicines, Project Seahorse, Montreal, Canada.

Wheeler, J.A. 1996. The marine aquarium trade: A tool for coral reef conservation. Sustainable Development and Conservation Biology Program, University of Maryland, Maryland, USA.

Wood, E.M. 2001. Collection of coral reef fish for aquaria: Global trade, conservation issues and management strategies. Marine Conservation Society, Ross-on-Wye, UK.

Philippine Coral Reef Fisheries: Diversity in Adversity[1]

PORFIRIO M. ALIÑO[2]
CLETO NAÑOLA[2]
WILFREDO CAMPOS[3]
VINCENT HILOMEN[4]
ANDRE UYCHIAOCO[2]
SAMUEL MAMAUAG[2]
[2]*Marine Science Institute, University of the Philippines (UP), Diliman, Quezon City*
[3]*College of Arts and Sciences, UP in the Visayas, Miag-ao, Iloilo*
[4]*Institute of Biological Sciences, UP Los Baños, Laguna*
Philippines

Introduction

The Philippines is blessed with having one of the most extensive coral reef areas (second only to Indonesia) found in the heart of the highest marine biodiversity region in the world. Reef fisheries have been estimated to directly contribute to around 15–30% of the total national municipal fisheries production (Carpenter and Alcala 1977; Murdy and Ferraris 1980). Total reef area in the Philippines covers around 27,000–44,000 km^2 (Carpenter and Alcala 1977; Gomez 1980; White and Cruz-Trinidad 1998; Burke *et al.* 2002).

It is no surprise that it is in the Philippines that reefs are at highest risk from overexploitation (Figure 1), destructive fishing and other human-related impacts such as coastal development and sedimentation (Burke *et al.* 2002). To date, over 70% of coral reefs in the country are in a poor state, and less than 5% are in excellent condition (Licuanan and Gomez 2002).

In addition, there is increasing evidence that susceptibility of reefs to El Niño-associated bleaching events and their rate of recovery is related to the well-being of their diverse assemblage of species and its functional integrity (e.g., trophic diversity) (Arceo *et al.* 2001; Cesar *et al.* 2001; Nañola *et al.* 2002). This suggests that it is difficult to tease out the effects of naturally induced stresses vis-à-vis human-induced ones. Jackson *et al.* (2001) showed that various fisheries in the world have undergone different phases of decline due to overexploitation, and that reefs are

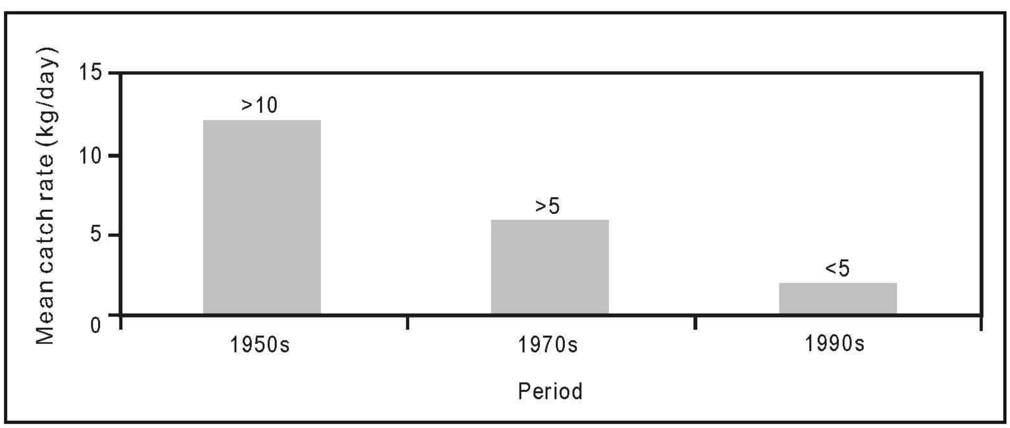


Figure 1. Mean catch rate (kg/day) of fishers in coral reef areas in the Philippines during different time periods (1950s-1990s) (adapted from Dalzell 1996; Uychiaoco and Torres 2002; Uy *et al.* 2002; Uy *et al.* 2003).

---

[1] This paper can be cited as follows: ALIÑO, P.M., C. NAÑOLA, W. CAMPOS, V. HILOMEN, A. UYCHIAOCO and S. MAMAUAG. 2004. Philippine coral reef fisheries: diversity in adversity, p. 65-69. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 1. Estimates of yield from various reef fisheries in the Philippines (compilations by Dalzell 1996 and White *et al.* 2000 based on independent studies).

Location	Area of reef (km^2)	Depth fished (m)	Yield ($t\ km^{-2} year^{-1}$)	Year of data collection
Sumilon Island	0.5	40	9.7	1976
Sumilon Island	0.5	40	14	1977
Sumilon Island	0.5	40	15	1978
Sumilon Island	0.5	40	23.7	1979
Sumilon Island	0.5	40	19.9	1980
Sumilon Island	0.5	40	36.9	1983
Sumilon Island	0.5	40	19.9	1985
Apo Island	1.5	60	11.4	1980
Apo Island	0.7	20	31.8	1985
Apo Island	1.06	60	24.9	1987
Selinog Island	1.26	30	6	1982
Hulao-hulao	0.5	15	5.2	1985
Pamilacan Island	1.8	20	10.7	1985
Bolinao Reef	42	reef slope	2.7	1990
Bolinao Reef	-	reef flat	12	1990
San Salvador	3.4	40	7	1989
San Salvador	3.4	40	14	1990

stark examples of phase shifts (i.e., coral to algal domination) in the habitat's benthic community structure.

Nowhere is the understanding of reefs and their management as challenging and frustrating as in areas of highest diversity and complex human development (Roberts *et al.* 2002). Learning from the Philippine experience is important to improve our understanding of reef ecosystems and effective management of reef fisheries. The complexity of the coral reef ecosystem is manifested in the country's varied fishing systems and gears in its highly diverse multispecies reef fisheries. Dalzell's (1996) review of catch rates in coral reef fisheries and data compiled by White *et al.* (2000) (Table 1) seem to suggest that Philippine catch rates are among the lowest in the world. The diminished catch rates (Figure 1 and Table 1), however, seem to be the result of the problem of overexploitation and destruction of reef habitats. Aliño and Dantis (1999) reviewed the application of an ecosystem model (Ecopath) (Walters *et al.* 1997) on a reef system in the Philippines, and their results suggest the vulnerability of reef fisheries to intense multispecies exploitation as has been previously suggested by Grigg *et al.* (1984). It is hypothesized that the high diversity of Philippine reefs has helped in its resilience to fishing pressure. The reported phase shifts in Caribbean reefs (Hughes 1994), which may have had a decade of lag-time in the face of extremely high fishing pressure, should serve as a warning to the Philippines.

The Case of Bolinao: No Sharks, No Sea Urchins and a Few Rabbitfish

The study by McManus *et al.* (1997) of the Bolinao reef fisheries shows that there might be a cascading effect in the change in species composition of its fish assemblages. Recently, it has been suggested that fish standing stocks in Bolinao have decreased to half its value two decades ago (Deocadez *et al.*, in press).

The case of Bolinao and Lingayen Gulf is a familiar one in many developing countries. Many of the fisheries management measures have been based on "demand-side" approaches (e.g., allowable catch for single species stocks). In addition, the development concerns of stakeholders have not been appropriately considered. For example, the scale of the stock boundaries (e.g., area of management vis-à-vis stakeholder and user domains and fisheries resources interaction) still needs to be effectively addressed.

In Bolinao, the declines in fishery resources have been perceived since the late 1980s but solutions to the situation have not been agreed upon by stakeholders in the area. Most fishers contend that there has not really been a considerable decline in stocks, but rather just an increase in the number of fishers. Initial interventions to regulate the harvest of major stocks (by banning commercial harvest of sea urchins, *Tripneustes gratilla*, and closed seasons for rabbitfish, *Siganus fuscescens*) have been too late and inadequate (Juinio-Meñez *et al.* 1998). The sea urchin stock has collapsed and smaller rabbitfish are now being harvested. A 150-ha sanctuary area was initially

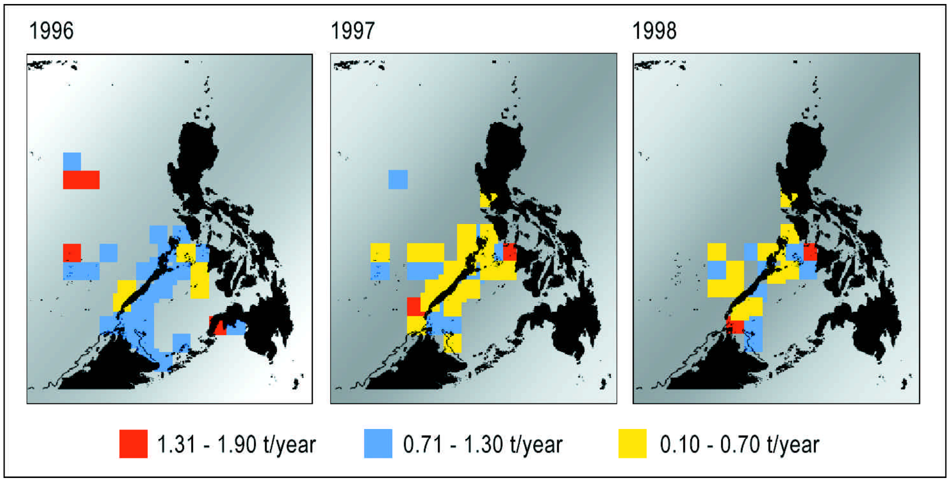


Figure 2. Mean catch-per-unit effort (t/drive/year) of *pa-aling* operations by 1° grid squares from 1996 to 1998 (Abesamis *et al.* 2000).

proposed based on the migratory spawning route of rabbitfish. After negotiating for over six years for establishment of the fish sanctuary, its size was considerably reduced to around 20 ha without any effective implementation. The primary resistance to establishment of a no-take fish sanctuary was that it would threaten the livelihood of over a thousand subsistence fishers in the area. Innovative ways had to be pursued to improve management, including facilitation for setting up *de facto* reproductive reserves (Arceo *et al.* 2002). Eventually, other village fishers were also motivated to establish growout areas for sea urchins and rabbitfish (Pastor *et al.* 2000; Juinio-Meñez *et al.* 2001).

The Bolinao experience shows that establishing no-take areas is important. However, with the complex multispecies fishery and diverse user groups, multi-pronged approaches are necessary to make any headway (Uychiaoco *et al.* 2003). In the case of initiatives in Palawan, as in Bolinao fisheries, management measures had to be pursued in the context of integrated coastal management (Arceo *et al.* 2002).

The importance of a "large picture" perspective is seen in the evolution of the commercial reef fishery using *muro-ami*. Banned in 1986, the clamor to lift the ban was seen more as a need to modify a fishing gear to be less destructive, rather than regulating a very effective and destructive gear (Miclat *et al.* 1991). Thus, the bubble-fishing scareline technique called *pa-aling* was developed to replace *muro-ami*. The development and eventual operations of *pa-aling* required that mechanisms for monitoring and evaluation of the fishery be put in place. Aside from addressing the child labor concerns associated with the gear, the area of operation was also restricted to Sulu Sea and South China Sea (Figure 2). Abesamis *et al.* (2000) showed the difficulties of implementing compliance to regulations in the fishing areas, further illustrating the complex challenges and diverse social issues associated with reef fisheries management.

Hope Springs Forth in Adversity

Despite the numerous frustrations experienced in managing reef fisheries (e.g., *muro-ami* and *pa-aling* commercial reef fisheries) (Miclat *et al.* 1991; Abesamis *et al.* 2000), coral reefs in the country have been the object for development of models for best practices in coastal resources management. The exemplary works of Alcala and co-workers (Alcala 2001) have shown promising results in the enhancement of adjacent artisanal fisheries (see also papers on marine protected areas in this volume – Hermes, White *et al.*, Aliño *et al.*). Juinio-Meñez *et al.* (2000) illustrated the potentials for stock enhancement through marine reproductive reserves as another avenue of opportunity. The potential of "shifter investments" such as ecotourism (White and Vogt 2000) and the linkage of livelihood options to effective coastal management are imperatives to address excess fishing effort.

A range of actions has been suggested to address the issues impacting reef fisheries in the Philippines. Discussed below are some of the important management directions.

Enhancing capabilities of local communities and promoting good local governance

Many fishing communities in the Philippines are overpopulated, diverse, with diffused artisanal technologies and in dire economic conditions. There is a need to address the disparity in income distributions, population growth and exacerbated conflicts of interest in fisheries. These issues require more equitable distribution of access and benefits derived from fisheries management. An important requisite is that the capabilities of communities are developed sufficiently so that they are socially prepared to undertake management at various levels (e.g., individuals, households and local governments). In many areas, good governance practices in fisheries management are lacking or corrupted. Transparency in giving fishing license concessions, fisheries registries and reliable reef fisheries statistics are wanting in most coastal municipalities. Nonaccountability of local government officials (e.g., coddling blast fishing and other illegal activities like poison fishing and the use of fine mesh nets) and nonimplementation/ nonenforcement of laws are widespread (and often referred to as lack of political will). Participatory decisionmaking is only starting to be appreciated in many municipalities (e.g., through Fisheries and Aquatic Resources Management Councils, if present and active).

Institutionalizing adaptive management and effective monitoring, control and surveillance system

Capabilities of communities and institutions at all levels need to be sustained through an adaptive management cycle. This cycle suggests that institutional arrangements and management measures should not be delayed due to insufficient knowledge. Through a precautionary approach based on best available knowledge, timely action should incorporate a way to gauge the effectiveness of management actions (e.g., monitoring the effectiveness of controlling illegal fishing). In areas where management controls are effective, there should be a feedback of information for further improvement of management (e.g., information, education and communication to reduce costs through improved coordination or to increase revenues due to better management). Earlier it was mentioned that available fisheries information (e.g., statistics) is insufficient to be effectively utilized for proactive management.

Innovative livelihood opportunities and sustained financing of resources management

Since reef fisheries are mostly artisanal, investments to motivate reduced fisheries extraction (e.g., ecotourism cases in the Visayas, White *et al.* 2000) or engender fisheries management stewardship are necessary (e.g., marine reproductive reserves and sea urchin growout such as in Bolinao). Broadening the income base and providing credit for the entrepreneurial poor would be important and would also require capability-building for the target beneficiaries. Linking fisheries management to the overall coastal management process would indicate many areas of opportunities in their financial planning and programming (e.g., increasing internal revenue allotments to fund management and appropriate prioritization and balancing of cost and revenue centers in local coastal management areas).

References

Abesamis, R., D. Jocson and P. Aliño. 2000. Commercial-scale fishing on Philippine coral reefs. (Abstract). Paper presented during the Ninth International Coral Reef Symposium, 22 October 2000, Bali, Indonesia.

Alcala, A.C. 2001. Marine reserves in the Philippines: Historical development, effects and influence on marine conservation policy. Bookmark, Makati City, Philippines. 115 p.

Aliño, P.M. and A. Dantis. 1999. Lessons from the biodiversity studies of reefs: Going beyond quantities and qualities of marine life, p. 78-85. *In* Proceedings of the Symposium on Marine Biodiversity in the Visayas and Mindanao, University of the Philippines in the Visayas, Iloilo, Philippines.

Arceo, H.O., M.M.S. Aguinaldo and P.M. Aliño. 2002. An orientation on marine protected areas: Coastal resources management tools. *In* Enhancing community participation in fishery resources management. Marine Science Institute, University of the Philippines, the Royal Netherlands Embassy and International Development Research Center, Canada. 45 p.

Arceo, H., M. Quibilan, P. Aliño, G. Lim and W. Licuanan. 2001. Coral bleaching in Philippine reefs: Coincident evidences with mesoscale thermal anomalies. Bull. Mar. Sci. 69(2): 579-593.

Burke, L., E. Selig and M. Spalding. 2002. Reefs at risk in Southeast Asia. World Resources Institute, Washington DC, USA. 72 p.

Carpenter , K.E. and A.C. Alcala. 1977. Philippine coral reef fisheries resources. Part II. Muro-ami and kayakas reef fisheries, benefit or bane? Philipp. J. Fish. 15: 217-235.

Cesar, H., L. Pet-Soede, M.C. Quibilan, P.M. Aliño, H. Arceo, I. Bacudo and H. Francisco. 2001. First evaluation of the impacts of the 1998 coral bleaching event to fisheries and tourism in the Philippines. *In* H. Schuttenberg (ed.) Coral bleaching: causes, consequences and response. Coastal Resources Center, University of Rhode Island, Rhode Island, USA.

Dalzell, P. 1996. Catch rates, selectivity and yields of reef fishing, p. 161-192. *In* N.V.C. Polunin and C.M. Roberts (eds.) Reef fisheries. Chapman and Hall, Florida, USA.

Deocadez, M., P. Aliño, A. Bautista, P. Gaite, B. Ronquillo and V. Prado. In press. Reef fish community dynamics indicators: Deriving lessons from Lingayen Gulf. Philipp. Sci.

Gomez, E. 1980. Status report on research and degradation problems of the coral reefs of the East Asian Seas. *In* Meeting of Experts to Review the Draft Action Plan for the East Asian Seas, 17-21 June 1980, Baguio City. UNEP/WG41/INF, South China Sea Fisheries Development Coordinating Program, Manila. 68 p.

Grigg, R.W., J.J. Polovina and M.J. Atkinson. 1984. Model of a coral reef ecosystem. III. Resource limitation, community regulation, fisheries yield and resource management. Coral Reefs 3: 23-27.

Hughes, T. 1994. Catastrophies, phase shifts and large scale degradation of a Caribbean coral reef. Science 265: 1547-1551.

Jackson, J.B.C., M.X. Kriby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner and R.R. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293: 629-638.

Juinio-Meñez, M.A.R, M. Malay and H. Bangi. 2001. Sea-urchin grow-out culture. Coastal resources management tools. Marine Environment Resources Foundation, Inc., Marine Science Institute, University of the Philippines, Quezon City, Philippines. 34 p.

Juinio-Meñez, M.A.R., N. Macawaris and H. Bangi. 1998. Community-based sea urchin (*Tripneustes gratilla*) grow-out culture as a resource management tool. *In* G.S. Jamieson and A. Campbell (eds.) Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Spec. Publ. Fish. Aquat. Sci. 125: 393-399.

Juinio-Meñez, M.A., S.G. Salmo III, E. Tamayo, N.G. Estepa, H.G. Bangi and P. Aliño. 2000. "Bugsay". Community environmental education: Experiences from Bolinao, northern Philippines. Community-based Coastal Resources Management Program, Marine Science Institute, University of the Philippines, Quezon City, Philippines. 126 p.

Licuanan, W.Y. and E.D. Gomez. 2002. Philippine coral reefs: Status and the role of the academe to improve their management. Proc. 9th Int. Coral Reef Symp. 2: 835-840.

McManus, J., R.B. Reyes and C.L. Nañola, Jr. 1997. Effects of some destructive fishing methods on coral cover and potential rates of recovery. Environ. Manage. 21(1): 69-78.

Miclat, R.I., P.M. Aliño, N. Aragones, C.L. Nañola Jr. and E. Aguilar. 1991. *Pa-aling:* An alternative to muro-ami? Philipp. J. Fish. 22: 29-38.

Murdy, E. and C. Ferraris. 1980. The contribution of coral reef fisheries to Philippine fisheries production. ICLARM Newsl. 3: 21-22.

Nañola, C.L. Jr., P.M. Aliño, A.L. Dantis, M.C. Rañola, V. Hilomen and J. Cabansag. 2002. Understanding Philippine reef fishes: A key to fisheries management and marine biodiversity conservation, p. 22-26. *In* P.M. Aliño, E.F.B. Miclat, C.L. Nañola, Jr., H.A. Roa-Quiaoit and R.T. Campos (eds.) Atlas of Philippine coral reefs. Goodwill Trading Co., Quezon City, Philippines.

Pastor, D., F. Castrence, P. Aliño and M.A. Juinio-Meñez. 2000. Challenges and frustrations in an over-fished multi-species reef fisheries. (Abstract). Paper presented during the Ninth International Coral Reef Symposium, 22 October 2000, Bali, Indonesia.

Roberts, C., C. McClean, J. Veron, J. Hawkins, G. Allen, D. McAllister, C. Mittermeier, F. Schueler, M. Spalding, F. Wells, C. Vynne and T. Werner. 2002. Marine biodiversity hotspots and conservation priorities for tropical reefs. Science 295(5558):1280-1284.

Uy, W., A. de Guzman, M. Quiñones and H. Dejarme. 2002. Participatory coastal resource assessment of the municipality of Tabina, Zamboanga del Sur, p. 49-78. Report to Philippine Environmental Governance Program (EcoGov-Mindanao), Quezon City, Philippines.

Uy, W., H. Dejarme, R. Abrea and M. Salarda. 2003. Participatory coastal resource assessment of the municipality of Tukuran, Zamboanga del Sur, p. 61-96. Report to Philippine Environmental Governance Program (EcoGov-Mindanao), Quezon City, Philippines.

Uychiaoco, A. and F. Torres, Jr. 2002. The fisheries of selected villages of Northern Palawan. Resource and ecological habitat assessment of the island-ecosystems in Northern Palawan and training on participatory coastal resource assessment, p. 89-99. Final Report. Path Foundation Philippines, Inc.

Uychiaoco, A., F. Castrence, Jr. and P.M. Aliño. 2003. A decade of Bolinao reef fish and fisheries: Part I. Fisheries, p. 18-23. *In* P.M. Aliño (ed.) Philippine coral reefs through time. Coral Reef Information Network of the Philippines (PhilReefs) and Marine Science Institute, University of the Philippines, Quezon City, Philippines.

Walters, C.J., V. Christensen and D. Pauly. 1997. Structuring dynamic models of exploited ecosystems from trophic mass-balance assessments. Rev. Fish Biol. Fish. 7: 1-34.

White, A.T. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines. 96 p.

White, A.T. and H. Vogt. 2000. Philippine coral reefs under threat: Lessons after 25 years of community-based reef conservation. Mar. Pollut. Bull. 40(6): 537-550.

White, A.T., H. Vogt and T. Arin. 2000. Philippine coral reefs under threat: The economic losses caused by reef destruction. Mar. Pollut. Bull. 40(7): 598-605.

Capture Fisheries for Larval and Juvenile Fish[1]

RUDOLF HERMES
Visayan Sea Coastal Resources and Fisheries Management Project
Bureau of Fisheries and Aquatic Resources-
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
Iloilo City 5000
Philippines

Preventing the continued and massive capture of fish that have not yet reproduced should be a major goal of fisheries management. This is to counter the downward production trend experienced in an increasing number of fishing grounds around the world (Des Clers and Nauen 2002). However, there are some specialized fisheries in the Philippines targeting postlarvae or early juveniles of certain fish species which are very marketable since they are considered delicacies. Others are targeted as seed stock for aquaculture production while the by-catch of these fry collection activities are usually left lying on the shore.

In many "wet" markets or fish markets around the country (from Southern Leyte to Batangas, Zambales and Iloilo) one can observe the sale of the grayish-white *dulong.* A variety of larval, postlarval and early juvenile fish species may be sold under this name. Often, these may consist of goby fry (some even claim that *dulong* is the dwarf pygmy goby *Pandaka pygmaea* Herre 1927, a threatened species on the IUCN Red List). *Dulong* are sometimes postlarvae or early juveniles of anchovies of the genus *Stolephorus* (Engraulidae), a fish taxon of great importance as food commodity, and perhaps even more so, as part of the marine food web. They are even considered an export commodity, marketed frozen as *lobo-lobo* (anchovies) to Taiwan or Japan. Locally, *dulong* is traded either fresh or dried. Only slightly older but still immature, dried anchovies are very popular fingerfood (spicy *dilis*).

Goby fry fisheries are taking place in many parts of the tropical Indo-Pacific Ocean as well as in the Caribbean, but the most important one in terms of production is reported from the Philippines (Bell 1999 and references therein). The bulk of these fisheries are highly seasonal and carried out in estuaries during certain moon phases; its targets are the postlarvae or fry of goby species of the genus *Sicyopterus* in Ilocos Norte (Ungson and Hermes 1985). Similar fisheries exist in parts of Northern Mindanao. Goby fry, locally called *ipon*, are usually preserved through a traditional fermentation process and marketed as *bagoong* (fish sauce).

A similar processing method is applied in the case of *padas*, the early juveniles of rabbitfish (Siganidae); most commonly *S. canaliculatus* (Park, 1797), but also larger growing siganid species of considerable economic importance as adults. The capture of *padas* is widespread in the Philippines, particularly in some parts of Pangasinan, northern Mindanao (Danao Bay, Lopez Jaena), Palawan and Cebu. In addition to fermentation, *padas* are also marketed dried. Another very popular food item are the juvenile stages of certain flatfishes (Bothidae), marketed also in dried form (*palad*) and consumed as snack food.

Best known among the fisheries for early life stages of fish is probably the collection of *bangus* fry, *Chanos chanos* (Forsskal , 1775). This activity is considered of great importance to the aquaculture industry and has been studied intensively over the years (e.g., Smith 1981; Ahmed *et al.* 2001 and references therein). This fishery of course differs from the above examples, as the target is not the immediate consumption, but the rearing and growout. Fry collection is seasonal with peak months from April to June and concentrated in general on the western provinces of the country. Utilizing traditional nonselective stationary gears and pushnets, the fry gatherers also collect large numbers of postlarvae and juveniles of other marine species. It can be assumed that most of these are discarded as unwanted and are destroyed on the beach. There is an urgent need for studies on the quantification of the by-catch problem which up to now is still hampered

[1] This paper can be cited as follows: HERMES, R. 2004. Capture fisheries for larval and juvenile fish, p. 70-71. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

by the dearth of expertise on ichthyoplankton taxonomy. It should be considered good news in this context that an increasing supply of *bangus* fry is now available from hatcheries.

There are, however, as yet no commercial hatchery facilities to supply the demand for early juvenile stages of certain species of groupers, *lapu-lapu* (Serranidae, Epinephelinae) which have become very popular in the local aquaculture and live fish trade. Juveniles and fingerlings – slightly larger though than in the above examples - for stocking fish cages are still collected from the wild which could lead to local overfishing of these predatory fish. The situation is aggravated by the still widespread use of cyanide in gathering activities, leading to great losses not only of the resource but also to the destruction of habitats.

Early life history stages of marine fish experience a relatively high natural mortality. Adding fisheries mortality as a consequence of these becoming the target of capture fisheries could easily lead to more severe overfishing. Local declines are already experienced in some *bangus* fry and *lobo-lobo* fisheries. Therefore, it not only makes good environmental, but also economic sense to protect and conserve enough young fish to allow these to reach maturity and reproduce. Matters are made more complicated and even worse through the fact that the Philippine Fisheries Code of 1998 (Section 89) can be interpreted as expressly allowing the use of very fine mesh net (which is banned otherwise) to capture early life stages of fish and small shrimps (*alamang*), contrary to the much needed protection and conservation measures for early life stages of fish.

Fisheries, for which overfishing is not only a threat, but already a common experience in many parts of the country, cannot afford to reduce recruitment through the systematic capture of postlarval, juvenile and immature fish. A considerable reduction or phaseout of these activities should therefore be pursued.

References

Ahmed, M., G.A. Magnayon-Umali, R.A. Valmonte-Santos, J. Toledo, N. Lopez and F. Torres, Jr. 2001. Bangus fry resource assessment in the Philippines. ICLARM Tech. Rep. 58, 38 p.

Bell, K.N.I. 1999. An overview of goby-fry fisheries. Naga 22 (4): 30-36.

Des Clers, S. and C.E. Nauen. 2002. New concepts and indicators in fisheries and aquaculture. ACP-EU Fish. Res. Rep. (13): 72 p.

Smith, I.R. 1981. The economics of milkfish fry and fingerling industry in the Philippines. ICLARM Tech. Rep. 1, 148 p.

Ungson, J.R. and R. Hermes. 1985. Species composition and relative abundance of goby fry and by-catch at Santa, Ilocos Sur in 1982/83. Fish. Res. J. Philipp. 10 (1/2): 1-8.

Fisheries in Deep-water Areas of the Philippines[1]

JIMELY O. FLORES
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

Deep-water areas as defined in this contribution include marine waters with depths exceeding 200 m. Of the Philippine territorial waters, about 88% (or 288,000 km^2) are deep-waters (Munro 1986) (Figure 1). These areas are truly extensive yet our knowledge about them is extremely meager. The deep-waters are fragile ecosystems. High pressure, low temperature, low dissolved oxygen and scarcity of food supply are characteristic environmental factors of deep-water areas, which affect the life history and distribution of organisms.

The ecology and biology of most deep-water organisms are less understood compared to their coastal, shallow-water counterparts. In deep-water ecosystems, species diversity is relatively higher and food-web structure is more complex compared to coastal, shallow-water environments. Most deep-water organisms have fragile life histories characterized by long life spans, slow growth rates, late ages at maturity and limited reproductive potentials. These make most deep-water organisms highly susceptible to collapse in the face of high fishing pressure.

Studies of Deep-water Areas

Despite the extensive area of our deep-waters, knowledge about their ecology, biology and productivity is relatively low. Past studies (Table 1) consist mostly of exploratory studies and surveys, with the biological component focused mainly on systematics or taxonomy. Pauly (1986) provided a concise review of these studies. Highlights of the more recent works are briefly discussed below.

There are at least 104 species recorded from deep-water studies in Panay Gulf, off Mindoro and off Marinduque. The species belong to various groups, viz. bonyfishes, cartilaginous fishes, jawless fishes, eels, shrimps, crabs and lobsters (Flores 1997, 2000; Ingles 1998; Ingles and Flores 2002). Figure 2 (a-c) illustrates variations in catch composition using Z-traps at different depth levels in Panay Gulf (off Guimaras Island). At shallower depths of about 200 m, eels and crabs dominate the catches. Eels are mostly composed of the genus *Conger* and *Ophicthus*; crabs, *Charybdis* and *Portunus*; shrimps, mostly *Plesionika*; and fishes consist of commonly marketed species caught in deeper shelf waters (i.e., threadfin breams, scorpion fishes, puffer fishes).

At over 200-400 m depth range, eels (mostly *Ophicthus* spp.) constitute a dominant portion (over 85%) of the catch. Shrimps, mostly *Heterocarpus* spp.; fishes, composed of ratfishes (Macrouridae and Moridae); and jawless hagfishes (*Eptatretus* spp.) become a significant part of the catch. At depths of more than 400 m, eels, jawless hagfishes and bonyfishes (ratfishes) more or less equally dominate the catch. Eels are of *Synaphobranchus* genus; shrimps are mostly of *Heterocarpus* spp.; and crabs are mostly spider crabs (family Majidae).

The composition of the catch of Z-traps set in deep waters off Marinduque and Mindoro shows similar dominance of eels. The various groups comprising the catch off Marinduque are shown in Figure 3 and off Mindoro, in Figure 4. The catch composition snapshots given in Figures 2 - 4 are reflective of species catchability to the particular fishing gear (Z-traps) used in the studies. Hence, these may not reflect actual relative abundance of various groups of living marine resources

[1] This paper can be cited as follows: FLORES, J.O. 2004. Fisheries in deep-water areas of the Philippines, p. 72-78. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

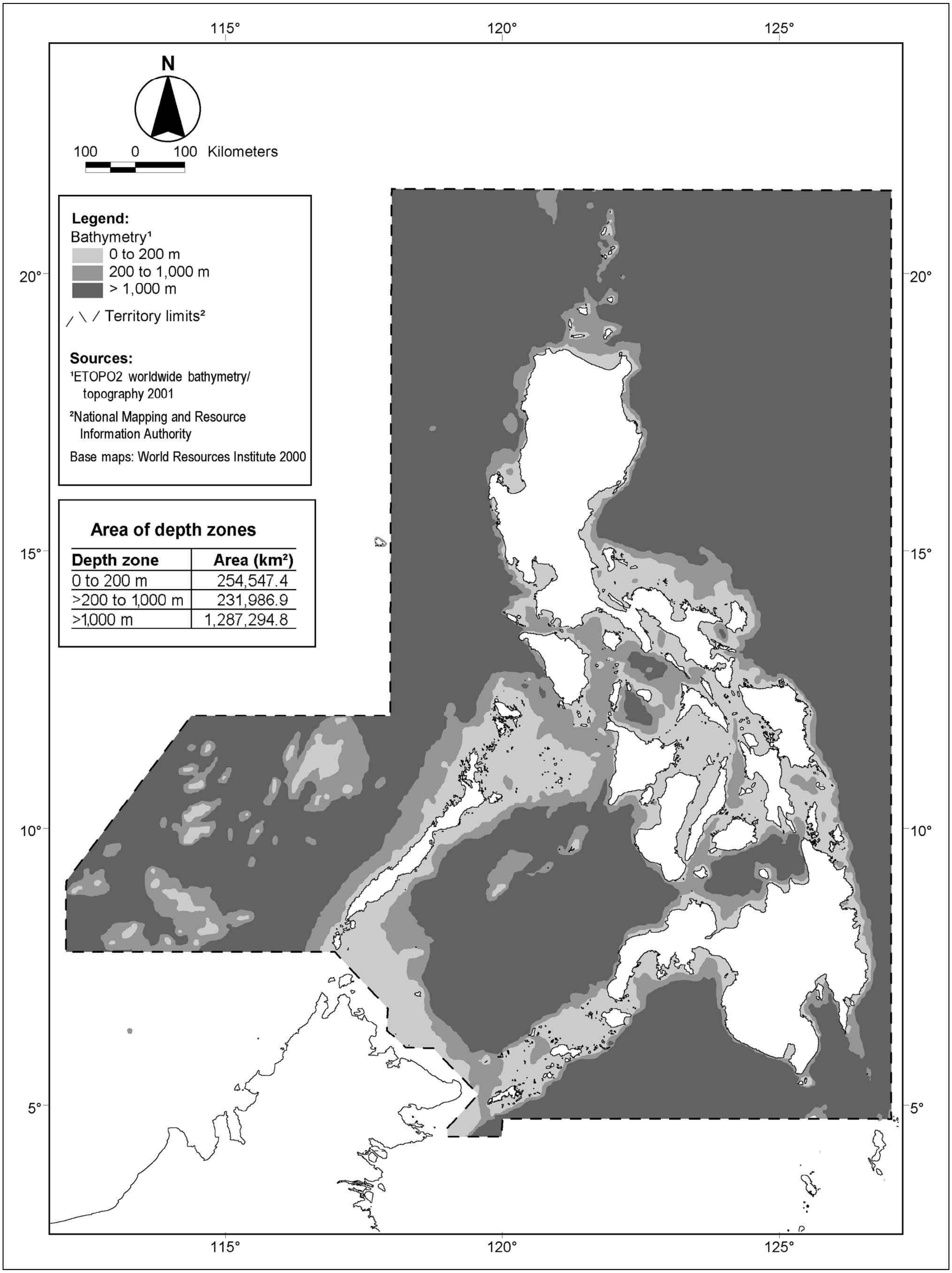


Figure 1. Map showing the deep-water areas (over 200 m depth) around the Philippines.

Table 1. Deep-water explorations and surveys in Philippine waters (Estampador 1937; Chace 1983; Pauly 1986; Estrellada 1991; Ingles 1992, 1998; Flores 1997, 2000; and Ingles and Flores 2002).

Year	Deep-sea Exploration/Survey
1799-1817	H *Samarang* exploration
1839-1843	HMS *Erebus and Terror* exploration
1857-1858	*Navarra* expedition
1873-1876	*Challenger* expedition
1907-1910	*Siboga and Albatross* expedition
1907-1912	*Planet* expedition
1927	*Emden* expedition
1929	RSS *Dana II* expedition
1930	HMS *Villebrord Snellius* expedition
1940s	*Cape Johnson* exploration
1948	Exploratory surveys for deepwater sharks
1950s	Exploratory surveys for a living fossil crustacean in Verde Passage
1951	*Galathea* expedition
1992	Resource and ecological assessment of Ormoc Bay
1996-1997	Survey of nontraditional invertebrate stocks in Panay Gulf
1998	Deepwater survey off Marinduque
2000	Deepwater survey off Mindoro
2001	Deepwater survey in Davao Gulf

in deep-water areas but at least illustrate a little on the ecology of deep-water areas in the Philippines.

Deep-water Fisheries in the Philippines

The deep-sea fisheries resources in the country are in many cases uncharted and unknown, and are believed to be relatively underexploited (Ingles and Babaran 1998). Fisheries activities in deep-sea areas are limited to surface waters of the pelagic region (see Zaragosa *et al.*, this vol., about fisheries for large and small pelagic species). The only deep-water fisheries resource that has a documented history of wide-scale exploitation is the dogfish shark. In most cases, a number of enterprising fishers undertake sporadic exploitation of deep-water resources, but these efforts are too few and scattered and thus remain largely undocumented.

Boom and bust story of the dogfish shark fishery

The dogfish shark (family Squalidae) fishing in the Philippines started in 1967 in San Joaquin, Iloilo, and subsequently expanded and developed into nationwide fisheries (Encina 1973). The main landing sites for dogfish shark fishers are shown in Figure 5. The species caught mostly belong to the genus *Centrophorus* (Table 2). The shark liver oil, from which the chemical substance called squalene is extracted, is exported to Japan, Hong Kong, USA and China. Squalene is used as additive to various health supplements and forms the base of many cosmetic products.

Dogfish sharks are mainly caught using bottom-set multiple hook-and-line. There are many variations of the gear, and differences lie mainly in the number and size of hooks and the rope materials used. The gear is baited either with salted or chopped fresh fish. Fishing techniques likewise vary among areas. In some areas, fishers prefer to set their gear at dusk and haul it at dawn, while in others, the gear is set at dawn and retrieved at noontime or late afternoon. However, most dogfish shark fishers prefer to fish at night.

In many places (like Batangas Bay, waters off Marinduque and as far south as Sarangani Bay), the fishery always starts as a highly profitable venture. The fishery, lacking effective management and based on a resource that is highly fragile to exploitation, usually collapses after about 10 years. When this happens, buyers pull out of the area and return only after about 6-10 years to resume buying operations. For example, the current dogfish shark fisheries off Marinduque, Bondoc Peninsula and Batangas restarted only three years ago after they ceased fishing operations in 1985. In the Mindanao area, dogfish shark fishing suffered the same boom and bust cycle over the years.

Evolving demersal and pelagic fisheries

The situation of capture fisheries throughout the country is fast changing. Because of unregulated fishing and overharvesting in coastal, shallow waters (near the

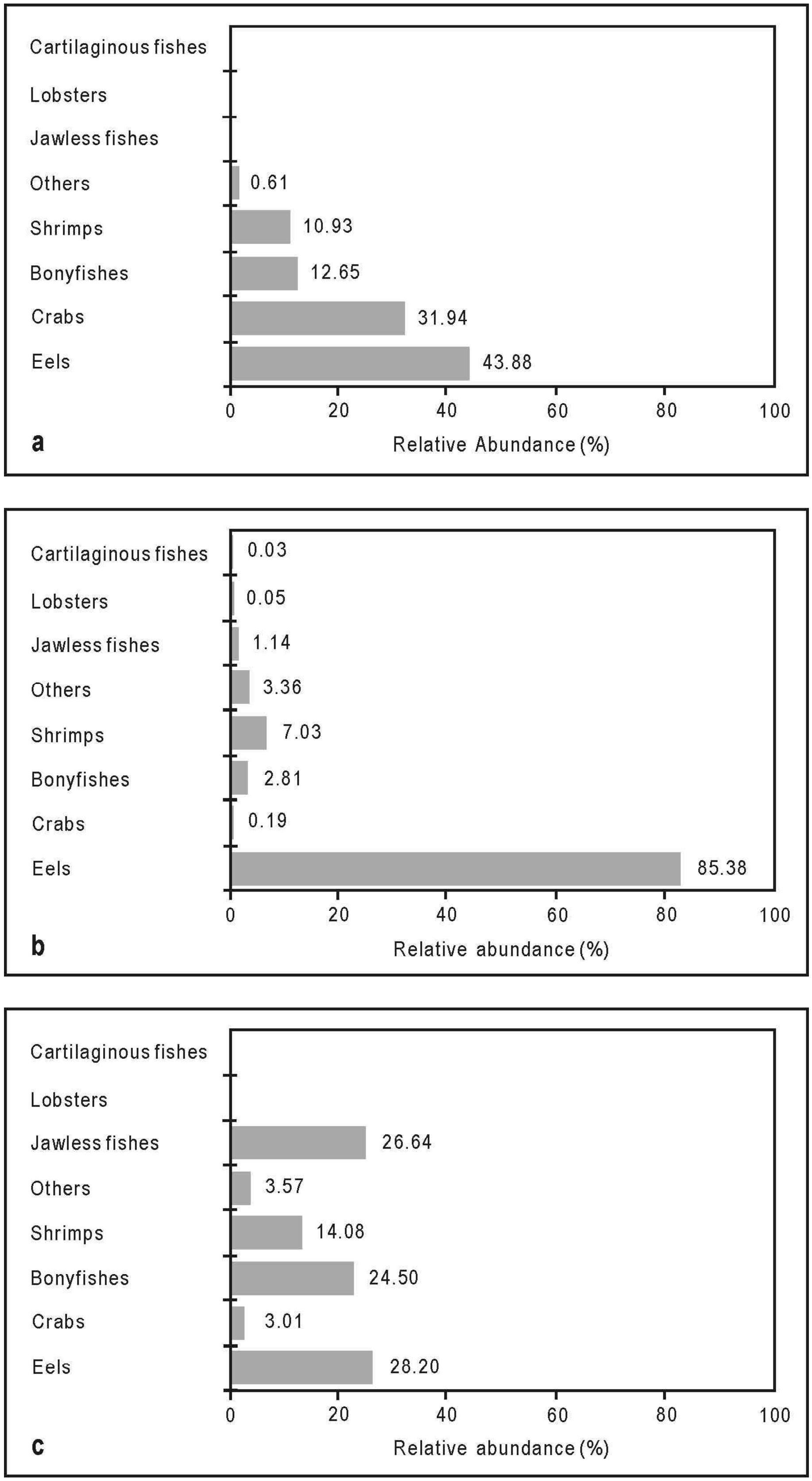


Figure 2. Composition of the catch of Z-traps in Panay Gulf set in: (a) about 200 m; (b) over 200-400 m; and (c) over 400 m (Flores 1997).

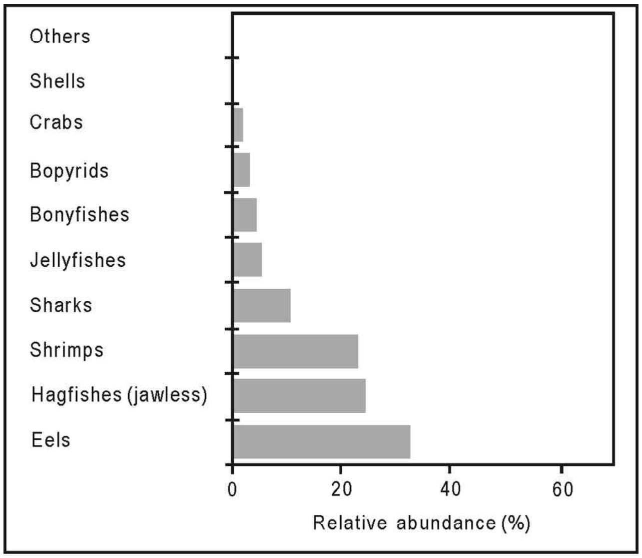


Figure 3. Composition of the catch of Z-traps set in deep waters off Marinduque (Ingles 1998).

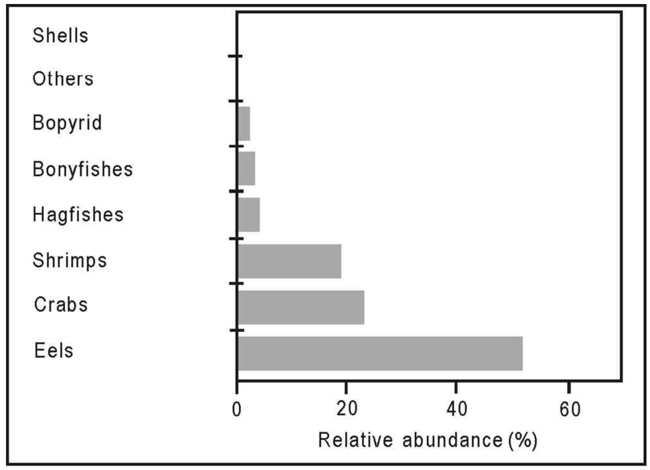


Figure 4. Composition of the catch of Z-traps set in deep waters off Mindoro Oriental (Flores 2000).

Table 2. Species of dogfish shark exploited for liver oil.

Centrophorus lusitanicus
Centrophorus isodon
Squalus blainvillei
Centrophorus cf mollucensis
Centrophorus cf rostrata
Centrophorus uyato
Centrophorus granulosus
Cymnorhinus licha

shoreline to 100 m depth where fishing activities have concentrated in the past), fishing grounds of both pelagic and demersal fisheries are advancing into deeper waters. Typical examples are the trap and hook-and-line fisheries in many areas.

The traditional hook-and-line fisheries have evolved in some areas as a consequence of the fast declining catch of most traditional fishing gears. Fishing operations have been modified to exploit deep-water resources. In Davao Gulf, the multiple hook-and-line *(panonton/palangre)* fisheries have evolved to operate in the deep-waters. Most of the deep-water fishers are from the southern part of Davao City. The fishing depths are between 150-400 m. Preliminary analysis of catch composition (Figure 6) shows that there are at least 7 kinds of fishes caught. The most common of these are *Trichiurius* spp. and what is locally called *bakalaw* (species identification still under verification). Preliminary analysis indicates an average catch rate of 5.3 kg/day. The catches have a high market potential. Even the *bakalaw*, which is not a familiar food fish to Filipinos, finds a ready market among Chinese residents of Davao City.

The conger eel, *Ophicthus urolophos*, is one of the major catches of deep-water traps in Panay Gulf, off Mindoro and off Marinduque. It is at present not a recognized food fish in the country. However, in Korea, this species is highly sought and is considered one of the most expensive processed food fishes.

The deep-water shrimps (*pasayang pula*) caught by traps in Davao Gulf at water depths of 200-600 m are mostly of the species *Plesionika* spp., *Heterocarpus sibogae* and *H. gibbosus*. In Davao City, where exploitation of these species started, most of the buyers are Taiwanese. A fisher usually uses only two traps per fishing operation baited with raw skewered duck meat.

Moreover, hagfishes (*Eptatretus* spp.) can also be a potential resource, maybe not as food fish but for industrial uses. Given the right technology and processing techniques, these species could become highly profitable fisheries in the Philippines.

Preparing for the Future

The pressure to exploit deep-water fisheries resources is growing given the highly depleted resources and increasing regulations in shallow water marine areas of the country. Deep-water areas are fast being considered as alternative fishing grounds. However, deep-water resources are already known as highly fragile to large-scale exploitation. The boom and bust story of the dogfish shark fisheries is a prime example.

It is therefore necessary that a national policy on the management of deep-water fisheries resources be enacted urgently. This is in order to prevent a fate similar to what many of our coastal fisheries resources have suffered. The government should take a proactive stand by installing a sound management plan that

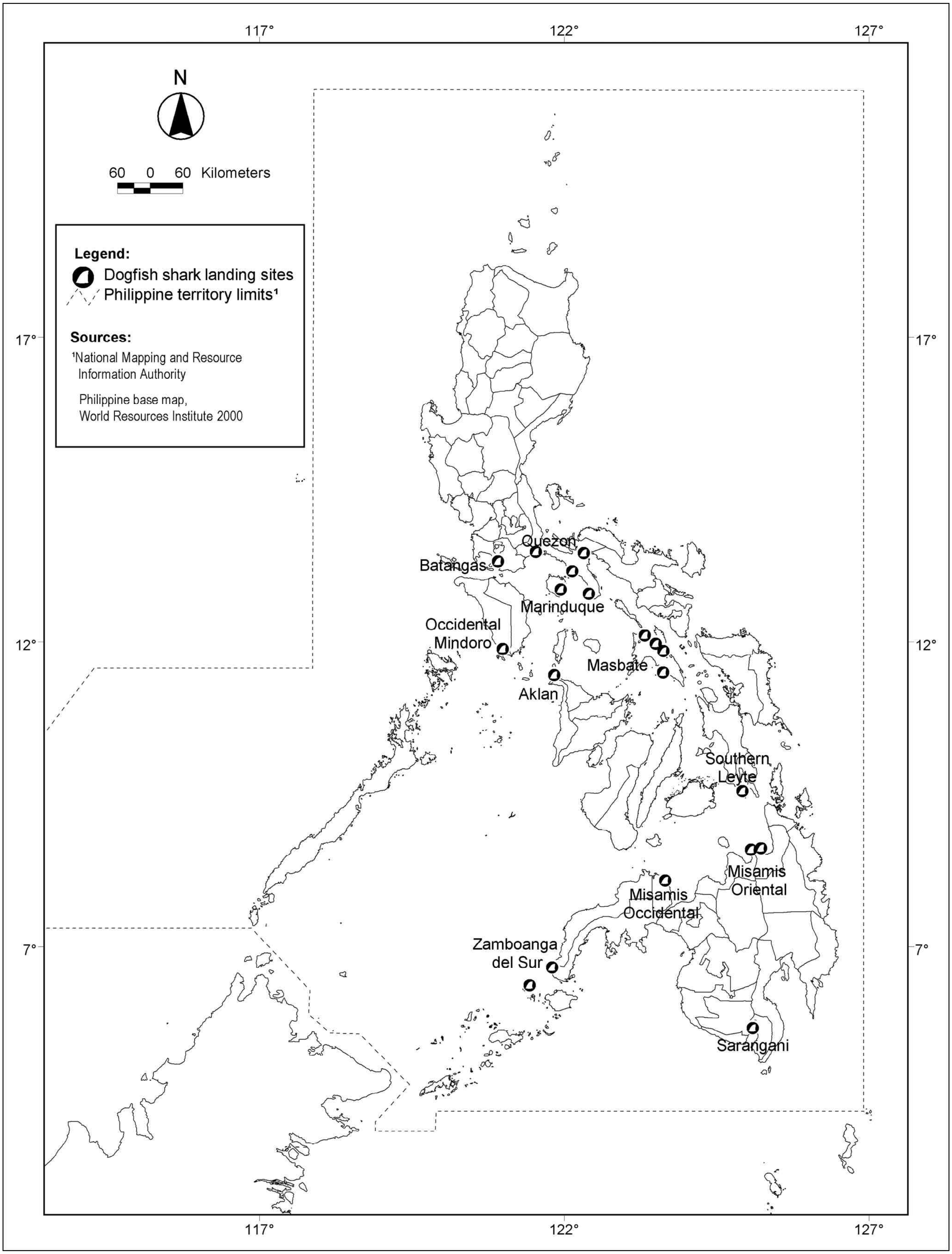


Figure 5. Main landing sites for dogfish sharks in the Philippines.

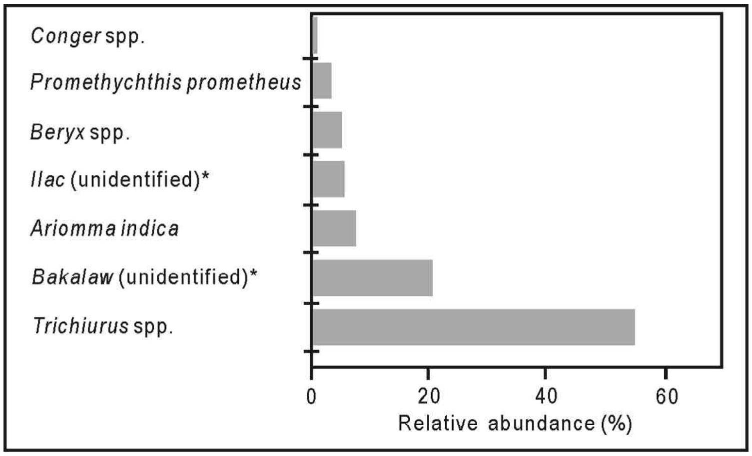


Figure 6. Composition of the catch of multiple hooks and line used in deep waters in Davao Gulf. (*Species still in National Museum awaiting identification.)

would regulate deep-water fisheries development in the country. Priority must also be given to collection of scientific information on, and sound assessment of, deep-water resources. Moreover, international experiences on the impacts of fishing on deep-water resources and ecosystems should be documented and lessons should be drawn for the country's benefit. The motto of "no science, no exploitation" should be heeded. After all, the deep-water resources are the country's very last frontier.

Precaution!

The deep-water resources may have a high potential. However, deep-water ecosystems and fishes are quite fragile compared to their coastal, shallow water counterparts. Irresponsible fishing practices will lead to their rapid collapse. Well-defined and appropriate management schemes, supported by sound scientific studies, must first be put in place before any fishery on these resources is even considered.

References

Chace, F.A., Jr. 1983. The caridean shrimps (Crustacea: Decapoda) of the Albatross Philippine Expedition, 1907-1910, Part I: Family Stylodactylidae. Smithsonian Contrib. Zool. No. 381. Smithsonian Institution Press, Washington, DC, USA.

Encina, V.B. 1973. The discovery and distribution of the spiny dogfish shark resource in the Philippines. Philipp. J. Fish. 11(1/2): 127-141.

Estampador, E. 1937. Checklist of Philippine crustacean decapods. Philipp. J. Sci. 62(4): 465-559.

Estrellada, R. 1991. A contribution to the biology of the deep sea prawn, (*Heterocarpus gibbosus* Bate, 1888, family Pandalidae) caught by trap in inner Davao Gulf. University of the Philippines in the Visayas, Iloilo, Philippines. 83 p. M.S. thesis.

Flores, J.O. 1997. Assessment of the fisheries potential of deep-sea resources in Panay Gulf, Philippines. College of Fisheries, University of the Philippines in the Visayas, Iloilo, Philippines. 92 p. M.S. thesis.

Flores, J.O. 2000. An evaluation of the fisheries resources off Pinamalayan, Oriental Mindoro. Woodward-Clyde Philippines, Inc. and URS International, Mandaluyong City, Philippines. 21 p. (Unpublished).

Ingles, J.A. 1992. Resource and ecological assessment of Ormoc Bay. Vol. 3. The fisheries of Ormoc Bay, Philippines. Fisheries Sector Program, Department of Agriculture, Quezon City, Philippines. 90 p.

Ingles, J.A. 1998. A survey of the deep water fisheries resources off Western Marinduque Island, Philippines. Woodward-Clyde Philippines, Inc. and URS International, Mandaluyong City, Philippines. 28 p. (Unpublished).

Ingles, J.A. and J.O. Flores. 2002. A resource survey of offshore and non-traditional invertebrates in Panay Gulf, Philippines. Bureau of Agricultural Research, Department of Agriculture, Quezon City, Philippines.

Ingles, J.A. and R. Babaran. 1998. Managing the fisheries of Guimaras Island. Final report. SMISLE-Zone 1. 240 p.

Pauly, D. 1986. A brief historical review of living marine resources research in the Philippines, p. 3-18. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socio-economics of the Philippine marine fisheries. Dept. Mar. Fish. Tech. Rep. 10, 217 p.

The Significance of Coastal Ecosystem Stewardship to Fisheries Productivity[1]

PORFIRIO M. ALIÑO[2]
MICHAEL P. ATRIGENIO[3]
MILEDEL CHRISTINE C. QUIBILAN[2]
MA. GREGORIA JOANNE P. TIQUIO[2]
[2]*University of the Philippines-Marine Science Institute*
Diliman, Quezon City 1101
Philippines
[3]*Conservation International*
Philamlife Homes, Quezon City
Philippines

Introduction

Production associated with coastal ecosystems contributes around 65% (i.e., municipal capture fisheries and aquaculture fisheries yields) of the total fisheries production of the Philippines. Marine capture fisheries consistently remain to be the most important sector of the country's fisheries. Aquaculture is expected to account for over 35% of the total harvests, and hence, complements overall fisheries production (Aguilar 2001). It remains to be seen, however, if it is realistic to expect an increase in commercial capture fisheries production considering the status of the various multispecies fisheries.

One of the great challenges of the fisheries sector is how it will be able to compensate for the projected deficits in fish supply given the increasing demand due to population growth. By the year 2010, if the annual population growth of the Philippines continues at 2.4%, then a considerable deficit in fisheries yield relative to per capita consumption is expected (Bernascek 1996). Silvestre (1989) cited initial delphi analyses of the various fishing areas in the Philippines and showed that most of these areas are already fully to overexploited (see also Fox's map in White and Cruz-Trinidad 1998). Aside from overfishing, habitat degradation and pollution are some of the other main concerns. Philippine fisheries are particularly vulnerable to perceptions of hazards to food safety and health, especially in the highly competitive and global economy.

An important factor that undoubtedly influenced the rate of utilization of coastal resources is the Philippine government's economic policies that inadvertently enhanced pressure on the marine environment. Padilla and Angeles (1992) attributed the accelerated rate of degradation of coastal resources to economic policies, such as subsidies, incentives, tax exemptions and lower tariff rates that resulted in increased fishing intensity, encouraged coastal habitat conversion and reduced wild stock resources. These impact on the economic viability of coastal industries (mariculture, tourism, fishing, fish processing and other related industrial / agricultural ventures) and the importance of the marine environment and its coastal habitats. The case study in Bacuit Bay, Palawan (Hodgson and Dixon 1988, 2000), is the only example in the country that examined the economic benefits of logging versus tourism and marine fisheries. The study showed a reduction in gross revenue of over US$40 million over a 10-year period with continued logging compared to the revenue generated if a logging ban is implemented.

Biodiversity of Coral Reefs: At Their Zenith But at Greatest Risk

Estimates of the extent of coral reef areas range from 25,000 km^2 (Gomez *et al.* 1994) to 33,500 km^2 (Carpenter 1977), depending on the varying assumptions of the maximum depth limits of where

[1] This paper can be cited as follows: ALIÑO, P.M., M.P. ATRIGENIO, M.C.C. QUIBILAN and M.G.J.P. TIQUIO. 2004. The significance of coastal ecosystem stewardship to fisheries productivity, p. 79-83. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

corals can be found. White and Cruz-Trinidad (1998) suggested that coral reefs could be one of the most important ecosystems in the Philippines due to their extensive area and the diversity and value of ecosystem goods and services they provide (Table 1). Licuanan and Gomez (2002) suggested that most of the coral reefs have declined based on the condition of the coral benthos. Fish biomass standing stock estimates, based on fish visual census, suggest that perhaps over 70% are in the low categories (i.e., less than 10 t km^{-2} $year^{-1}$; see also Hilomen *et al.* 2000 and Nañola *et al.* 2002). If a production to biomass ratio (P/B) of 1.5 is assumed for reef fish (Polovina 1984), and around 20% of the fish seen in the underwater fish visual census are target species, then the potential annual fisheries production would be only around 3 t km^{-2} $year^{-1}$. This suggests that there is considerable reduction of potential annual yields due to degradation of coral reef habitats (i.e., based on a conservative maximum sustainable yield for good reefs of about 12 t km^{-2} $year^{-1}$). Thus, at present poor reefs lose at least 60% of their productive potential.

Thus it comes as no surprise that recent updates (utilizing data from over 50 areas revisited in at least two succeeding years) confirm the intuitive perceptions that reefs in the Philippines have experienced substantial declines (PhilReefs 2003). One of the most popular initiatives that have been undertaken to reduce the impacts on coral reefs is the establishment of marine protected areas (MPAs). Many of the effective MPAs have been seen in the Visayas region (Alcala 2001; White and Vogt 2001; Aliño *et al.* 2002). These efforts need to be integrated into a more comprehensive coastal management framework and strategy (DENR-DA-BFAR-DILG 2001; Aliño *et al.* 2002).

Sustaining Seagrass and Mangrove Conservation: An Imperative to Maintain Aquaculture Productivity

The productivity of mangrove forests has been well recognized (Zamora 1995; Fortes 1991) and may even exceed that of coral reef areas. The diversity of mangrove species in the Philippines is among the highest globally. However, the significance of the functional diversity of mangroves (e.g., complex food web and connectivity to adjacent coastal systems) has not been fully appreciated in the country. The strategic position of mangroves between land and sea makes it an important buffer area (providing protection from storm, erosion and siltation). It also functions as spawning, nursery and feeding ground for a variety of organisms. Recent reviews by Primavera (1995, 2000) highlight the competing interests of aquaculture (fishpond conversion) and mangrove conservation, particularly during the 1970s. Mangrove degradation and conversion to fishpond has been implicated in the decline of the country's natural fish stocks (Primavera 1995) (Figure 1).

No comprehensive evaluation of the seagrass cover in the country has been undertaken (see Fortes and Santos, this vol.). This is probably due to the extensive geographic distribution and depth range (intertidal and subtidal at around 1-30 m) of the seagrass communities and the limited resources devoted to their study. Seagrasses are functionally linked to coral reefs and mangroves (Fortes 1988, 1991, 1995), and the degradation and loss of seagrass beds affect these adjacent systems. The interconnectivity of coral reefs to mangroves through seagrass beds makes the latter more sensitive to changes in the environment.

Table 1. Total annual national economic benefits derived from coral reefs, fisheries and mangroves in the Philippines, 1996 (White and Cruz-Trinidad 1998).

Ecosystem/Resource	Area/Yield	Value (in US$)
Coral reefs	27,000 km^2	1.35 billion
Fisheries		
Tourism		
Coastal protection		
Mangroves	140,000 ha	84 million
Fisheries		
Wood[a]		
Other contributions		
Fisheries	Open marine water	1.25 billion
Municipal (less reef fish)	909,000 t	0.64 billion
Commercial	879,000 t	0.61 billion
Aquaculture	Brackish and marine 981,000 t	0.83 billion
Total (1998: $1 = P40)	(P140.56 billion)	3.5 billion

[a]Wood is not included because legally, there is little mangrove wood harvesting allowed.

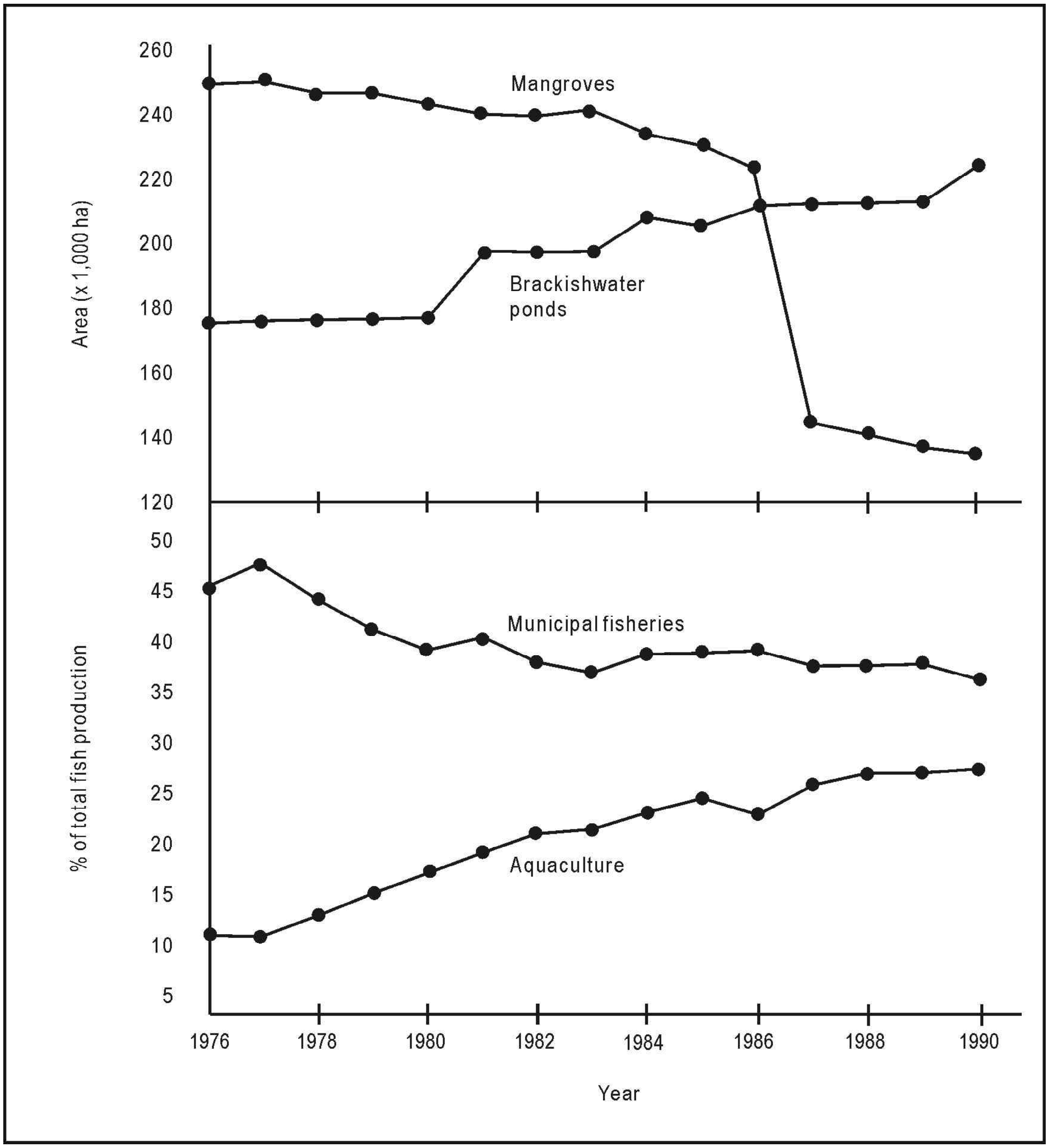


Figure 1. Relative decline in municipal fisheries production due partly to the conversion of mangroves to fishponds (Primavera 1995).

Seagrass communities can be good indicators of the health or condition of the entire coastal ecosystem (Fortes 1995).

Yield from seagrass beds can be over 10 t km^{-2} $year^{-1}$ of fish alone, with a production potential of 20 t km^{-2} $year^{-1}$ of fish, invertebrates and seaweeds combined (McManus *et al.* 1992). Siganids (rabbitfish, *danggit*) are the most abundant fish and occur in seagrass beds as adults and juveniles. The country's extensive coastline has extensive seagrass habitats that also serve as feeding ground of the highly endangered Dugong (*Dugong dugon*) and marine turtles (*Chelonia mydas* and *Eretmochelys imbricata*). To a lesser extent, sightings have been recorded of the Olive ridley (*Lepidochelys olivacea*), Leatherback (*Dermochelys coriacea*) and the more rare Loggerhead turtle (*Caretta caretta*) in seagrass beds. Recommendations for management, conservation and sustainable use of seagrasses in the country have been made by Fortes (1995). An integrated approach towards seagrass and mangrove ecosystems management considering habitat interconnections has also been proposed (Fortes 1988, 1991).

Meeting the Ecosystem Challenges of Our Fisheries

One may note that the Philippines is found in the most diverse marine region in the world. Its

Figure 2. Proliferation of fishpens in Lingayen Gulf.

multispecies and multigear fisheries manifest the varied range of problems in the use of such diverse marine resources in a developing country context. The country's fisheries experience indicates shifts in species composition together with substantive declines in fisheries yield (see Dalzell *et al.* 1987). In many fishing areas, coping with varying degrees of environmental stress induced by human impacts interacts with fisheries overexploitation (Pauly and Chua 1988; Padilla and Morales 1997) (Figure 2).

The destruction of coastal habitats will likewise cause a decline of marine resources dependent on these habitats, thus exacerbating the high poverty rate in coastal communities. Malthusian overfishing (related to increasing fisher populations and the open-access nature of the marine environment) has led to further heavy exploitation and abuse of resources (Pauly *et al.* 1989). Burke *et al.* (2002) showed that destructive fishing, together with overfishing, is the most prevalent problem in the coral reefs of the Philippines. Roberts *et al.* (2002) indicated that the country is the "hottest of the hotspots" in the world.

Given the multiplicity of proposed interventions, the convergence of various initiatives toward ecosystem approaches makes for more effective and sustainable fisheries management. The inroads into marine sanctuaries and MPAs have already shown promising results (Alcala 2001). Juinio-Menez *et al.*'s (1998) works utilizing co-stewardship by fishers and marine reproductive reserves have shown good promise in areas where fisheries stocks have been depleted.

The management of aquaculture and capture fisheries has not only become a sectoral concern but highlights the need for integrated coastal zone management. In a developing country like the Philippines, sustainable utilization can only be achieved if sufficient participation in decisionmaking becomes part of management. There is greater need to enhance adaptive management where fisheries monitoring and ecosystem management are linked to proactive responses and effective feedback mechanisms. Incentive and disincentive systems that facilitate public-private partnerships need to be pursued. Learning from the application of management tools and good practices, as well as education and empowerment of communities in co-management with local governments, are also critical keys to sustaining our municipal and commercial fisheries. Sustainable fisheries require effective stewardship by stakeholders, and it is good business sense to care for the ecosystems that sustain fisheries productivity.

References

Aguilar, G.D. 2001. The national integrated research development extension agenda and program for capture fisheries. (Abstract) International Seminar on Responsible Capture Fisheries in Coastal Waters of Asia: Case Studies and Researches for Sustainable Development and Management of Tropical Fisheries, 24-27 September 2001, Iloilo, Philippines. Japan Society for the Promotion of Science and College of Fisheries and Ocean Sciences, University of the Philippines-Visayas, Miagao, Iloilo. 3 p.

Alcala, A.C. 2001. Marine reserves in the Philippines: Historical development, effects and influence on marine conservation policy. Bookmark , Makati City, Philippines. 115 p.

Aliño, P.M., H.O. Arceo, N.E. Palomar and A.T. Uychiaoco. 2002. Challenges and opportunities for marine protected area (MPA) management in the Philippines. Proc. Ninth Int. Coral Reef Symp. 2: 635-640.

Bernascek, G. 1996. The role of fisheries in food security in the Philippines: A perspective study for the fisheries sector to the year 2010. Paper presented during the Second National Fisheries Policy Planning Conference, Puerto Azul, Cavite, Philippines.

Burke, L., E. Selig and M. Spalding. 2002. Reefs at risk in Southeast Asia. World Resources Institute, Washington DC, USA. 72 p.

Carpenter, K.D. 1977. Philippine coral reef fisheries resources. Philipp. J. Fish. 17: 95-125.

Dalzell P., P. Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. BFAR Tech. Pap. Ser. 10(3): 23 p.

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001. Philippine coastal management guidebook no. 5: Managing coastal habitats and marine protected areas. Coastal Resource Management Project of DENR, Cebu City, Philippines. 106 p.

Fortes, M.D. 1988. Mangroves and seagrass beds of East Asia: Habitats under stress. Ambio 17 (3): 207-213.

Fortes, M.D. 1991. Seagrass-mangrove ecosystems management: A key to marine coastal conservation in the ASEAN region. Mar. Pollut. Bull. 23: 113-116.

Fortes, M.D. 1995. Seagrasses of East Asia: Environmental and management perspectives. RCU/EAS Tech. Rep. Ser. No. 6: 75 p. UNEP, Bangkok.

Gomez, E.D., P.M. Aliño, H.T. Yap and W.Y. Licuanan. 1994. A review of the status of Philippine reefs. Mar. Pollut. Bull. 29: 62-68.

Hilomen, V.V., C.L. Nañola and A.L. Dantis. 2000. Status of Philippine reef fish communities, p. 14. (Abstract). *In* Proceedings of the Workshop on the Status of Philippine Reefs. University of the Philippines-Marine Science Institute, Quezon City, Philippines.

Hodgson, G. and J.A. Dixon. 1988. Logging versus fisheries and tourism in Palawan. Occas. Pap. No. 7. East-West Environment and Policy Institute, Hawaii, USA.

Hodgson, G. and J.A. Dixon. 2000. El Nido revisited: Ecotourism, logging and fisheries, p. 55-68. *In* H.S.J. Cesar (ed.) Collected essays on the economics of coral reefs. CORDIO, Department for Biology and Environmental Sciences, Kalmar University, Kalmar, Sweden.

Juinio-Meñez, M.A.R, N.D. Macawaris and H.G.P. Bangi. 1998. Community-based sea urchin (*Tripneustes gratilla*) grow-out culture as a resource management tool. *In* G.S. Jamieson and A. Campbell (eds.) Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Can. Spec. Publ. Fish. Aquat. Sci. 125: 393-399.

Licuanan, W.Y. and E.D. Gomez. 2002. Philippine coral reefs: Status and the role of the academe to improve their management. Proc. Ninth Int. Coral Reef Symp. 2: 835-840.

McManus, J., C.L. Nañola, R.B. Reyes Jr. and K.N. Kesner. 1992. Resource ecology of the Bolinao coral reef system. ICLARM Stud. Rev. 22, 117 p.

Nañola C.L. Jr., P.M. Aliño, A.L. Dantis, M.C. Rañola, V. Hilomen and J. Cabansag. 2002. Understanding Philippine reef fishes: A key to fisheries management and marine biodiversity conservation, p. 22-26. *In* P.M. Aliño, E.F.B. Miclat, C.L. Nañola, Jr., H.A. Roa-Quiaoit and R.T. Campos (eds.) Atlas of the Philippine coral reefs. Philippine Coral Reef Information (PhilReefs) and Goodwill Trading Co., Inc., Quezon City, Philippines.

Padilla, J.E. and A.C. Morales. 1997. Evaluation of fisheries management alternatives for Lingayen Gulf: An options paper. *In* Studies on Lingayen Gulf. Final Report of the Philippine Environmental and Natural Resources Accounting Project (ENRAP-Phase IV). 32 p.

Padilla, J.E. and M. Angeles. 1992. Economic policies and the sustainable development of coastal resources in the Philippines. Naga 15(3): 36-40.

Pauly, D. and T.E. Chua. 1988. The overfishing of marine resources: Socioeconomic background in Southeast Asia. Ambio 17(3): 200-206.

Pauly, D., G. Silvestre and I.R. Smith. 1989. On development, fisheries and dynamite: A brief review of tropical fisheries management. Nat. Resour. Modelling 3: 307-329.

Philreefs (Coral Reef Information Network of the Philippines). 2003. Philippine coral reefs through time: workshop proceedings. University of the Philippines-Marine Science Institute, Quezon City, Philippines, and Marine Parks Center, Tokyo, Japan. 197 p.

Polovina, J.J. 1984. Model of a coral reef ecosystem. Part I. The ECOPATH model and its application to French Frigate Shoals. Coral Reefs 3: 1-11.

Primavera, J.H. 1995. Mangroves and brackish water pond culture in the Philippines. Hydrobiologia 295: 303-309.

Primavera, J.H. 2000. Development and conservation of Philippine mangroves: Institutional issues. Ecol. Econ. 35(1): 91-106.

Roberts, C.M., C.J. McClean, J.E.N. Veron, J.P. Hawkins, G.R. Allen, D.E. McAllister, C.G. Mittermeier, F.W. Schueler, M. Spalding, F. Wells, C. Vynne and T.B. Werner. 2002. Marine biodiversity hotspots and conservation priorities for tropical reefs. Science 295: 1280-1284.

Silvestre, G.T. 1989. Philippine marine capture fisheries: Exploitation, potential and options for sustainable development. Work. Pap. No. 48. Stock Assessment Collaborative Research Support Program, College of Fisheries, University of the Philippines-Visayas, Quezon City, Philippines.

White, A.T. and A. Cruz-Trinidad 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines. 96 p.

White, A.T. and H.P. Vogt. 2001. Philippine coral reefs under threat: Lessons after 25 years of community-based reef conservation. Mar. Pollut. Bull. 40(6): 537-550.

Zamora, P.M. 1995. Diversity of flora in the Philippine mangrove ecosystem. Biodivers. Conserv. Rep. 1, 92 p. University of the Philippines-Center for Integrative and Development Studies, Quezon City, Philippines.

Mangrove Resource Decline in the Philippines: Government and Community Look for New Solutions[1]

ALAN T. WHITE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area
Cebu City 6000
Philippines

ROY OLSEN D. DE LEON
Silliman University Marine Laboratory
Dumaguete City, 6200 Negros Oriental
Philippines

Introduction

Mangrove forest cover in the Philippines has declined substantially during the last century. From an estimated 450,000 ha of mangroves in 1918, less than 140,000 ha exist (Figure 1). At present, 95% of the remaining mangroves are secondary growth and only 5% are old or primary mangroves that are mostly found in Palawan (Brown and Fischer 1918; DENR 1988). Thus, mangrove forests remaining along Philippine coasts today are of much lower quality than 50 years ago and cover less than one-third of their original area. This has occurred because of the lack of awareness on the substantial economic and ecological contribution of this ecosystem to society.

The most rapid decrease occurred during the 1960s and 1970s when government policies encouraged the expansion of aquaculture. Today, fishponds cover about 289,000 ha, 80 to 90% of which are in areas once covered with mangroves (DENR 1989; ADB 1993). This expansion occurred largely during a period when real prices for fish and shrimp were steadily rising. From 1918 to 1970, an average of 3,100 ha of mangroves were lost yearly. Then from 1980 through 1988, despite a 1980 government ban on further conversion of mangroves to fishponds, the rate of reduction increased to about 8,200 ha annually (DENR 1988). However, conversion of mangrove areas to fishponds has sometimes been the final step in a process of destruction that began with overharvesting of mangroves for fuelwood, frequently by persons other than those who ultimately built the fishponds (World Bank 1989).

Cutting of mangroves for fuelwood, charcoal making and construction is probably the second most pervasive intrusion on the resource. The demand for these products leads to illegal cutting, overharvesting, and subsequent degradation of the habitat and ecosystem. This, in turn, contributes to the decline of nearshore fisheries. Degraded areas are more easily reclassified as disposable lands, making conversion more likely to other uses.

The deterioration of mangrove resources has stimulated various responses to slow and reverse the process. Laws have been passed protecting mangroves. Policies have been suggested to provide economic disincentives to the conversion of mangrove forests for fishpond use. Since 1990, various community-based projects have engaged coastal residents in reforestation, rehabilitation and management efforts. This paper describes the new policy directions of the government and summarizes management efforts to reverse the decline of mangroves.

---

[1] This paper is an updated version of an article which originally appeared as: WHITE, A.T. and R.O.D. DE LEON. 1996. Mangrove resource decline in the Philippines: Government and community look for new solutions. Tambuli (1): 6-11.

This paper can be cited as follows: WHITE, A.T. and R.O.D. DE LEON. 2004. Mangrove resource decline in the Philippines: Government and community look for new solutions, p. 84-89. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

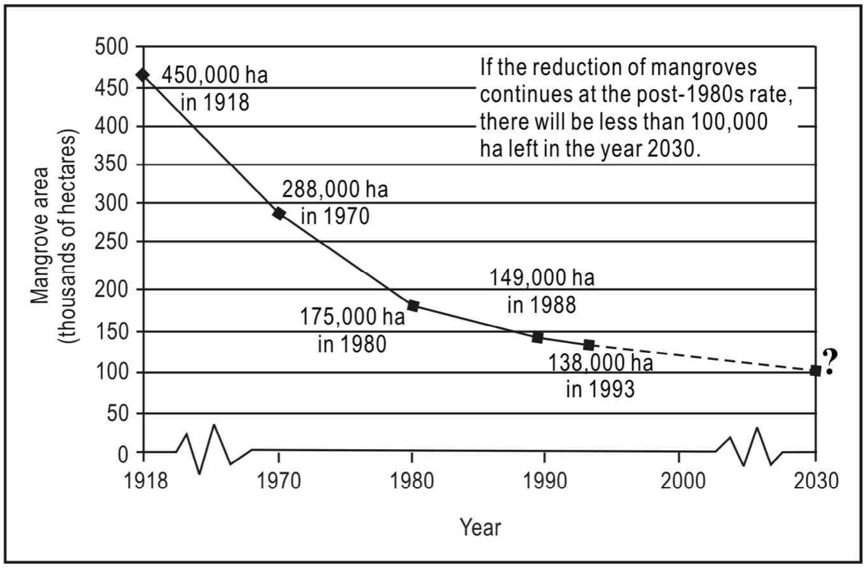


Figure 1. Mangrove resource decline in the Philippines (DENR 1988; World Bank 1989).

National Policies to Encourage Mangrove Conservation

The Bureau of Fisheries and Aquatic Resources (BFAR) is responsible for licensing the development of fishponds on government land. About 95,000 ha has been allocated for the development of fishponds of which about 63,000 ha is under 25-year fisheries lease agreements (FLA). Another 16,000 ha is under short-term leases and about 8,000 ha has been turned over to private ownership. Some are illegally occupied, and about 17,000 ha was undeveloped in 1990 (Schatz 1991). Presently, the Fisheries Code of 1998 (Section 49) authorizes the reversion of all abandoned, undeveloped or underutilized fishponds to mangrove habitat.

One problem with FLAs is that the fees and yearly rental are extremely low (about $2/year/ha). This means that conversion to fishponds carries no penalty for low production and pays little back to the government or local community for losses associated with conversion of mangrove systems. In fact, many of the fishpond areas under lease are underused or not used at all for aquaculture while the natural fisheries and wood resource values of the mangrove system have already been lost.

A large Fishery Sector Program (FSP) for the Philippines started in 1991 by immediately supporting several economic and policy studies concerning mangroves. The economic analysis showed that the fishpond lease fee was way too low to: (1) encourage efficiency in the use of land for fishponds; and (2) discourage the conversion of mangrove swamp area for aquaculture.

The opportunity cost for the replacement of mangrove systems was determined to be quite high and was consistent with studies in other countries. Dixon (1989) had reported that estimates of opportunity cost of 1 ha of complete mangrove ecosystem to be $500-$1,550 annually. The FSP study

Table 1. Estimated net annual economic value ($) of Philippine mangrove areas for different levels of management (Schatz 1991).

Level of Management	Wood Products (Value/ha)	Fish Products (Value/ha)	Total
Mangrove plantation	$156	538	694
Managed, naturally regenerated	90	538	628
Unmanaged, understocked stranges	42	538	580

Note: Wood harvest value was based on average price of about $\$12/m^3$ of wood; fish products were based on average annual weight of fish and shrimp/ha associated with mangrove areas and an average price of $.80/kg; values were based on Philippine peso (P) amounts in 1991 and converted at P25/$1 (Schatz 1991).

summarized various researches made on the minimum economic rent for 1 ha of intertidal land in the Philippines into $550 annually (Table 1). The amount determined by White and Cruz-Trinidad (1998) to be an acceptable economic equivalent for what is lost if mangroves are converted to other uses is $600/ha/year[2].

The FSP study recommended that FLA lease fees be raised to $360 to 800/ha/year (Schatz 1991). The study also recognized that the value attributed to marine fishery products dependent on mangrove system health was underestimated and that more research was needed. It was thus suggested that the basic wood value of mangrove stands be used as the initial economic rent level, which was about $156/year/ha. This would mean that at a very minimum, the fishpond leases should provide this amount per year to the Philippine government. Although a schedule was recommended to implement an increase of lease fees over several years, this was not accomplished because of resistance from leaseholders and political intervention. In spite of reluctance among leaseholders to the increased fees, it is ironic that the Philippine rental market for privately held fish and shrimp ponds flourishes and derives annual rents from about $120 to 600/ha/year.

National laws (Presidential Proclamation 2146, 1982; Republic Act 7161, 1991) prohibit the cutting of any mangroves in the country. Most important mangrove forests are legally protected in forest reserves. But these laws have not prevented the mangrove forest decline. This situation has prompted the government to attempt mangrove reforestation in abandoned fishponds and other areas previously occupied by mangroves, with the assistance of projects and new policies.

The mangrove decline has stimulated experiments in reforestation using contracts with local communities through community-based forest management agreements (CBFMAs) and encouraged communities to protect and manage the resource in their own ways. The first national policy on mangrove management that encouraged community-level stewardship, Department of Environment and Natural Resources Administrative Order (DAO) 15, was issued in 1990. This provided long-term security of tenure through the issuance of Mangrove Stewardship Agreements. In 1994, the nongovernment organization (NGO)-assisted community-based mangrove forest management approach was endorsed by DENR (DAO 30, S and Executive Order [EO] 263). Twelve DAOs of DENR from 1996 through 1998 specify the rules and regulations for the implementation of CBFMAs through the assistance of NGOs or people's organizations (POs) together with the local government unit (LGU) concerned (Melana *et al.* 2000).

The CBFMA is a production sharing agreement entered into between a community and the government to develop, utilize, manage and conserve a specific portion of forestland consistent with the principles of sustainable development and pursuant to an approved Community Resource Management Framework Plan (CRMF) (DAO 96-29). CBFMAs are used by DENR to award tenure rights over forestlands to organized communities. It virtually integrates all of the old tenure instruments on forestlands prior to 1996 (Melana *et al.* 2000).

The legal conflict between proposals to totally ban mangrove cutting versus the need to allow limited use by community groups arranged for CBFMAs impedes the successful outcome of these agreements. In most cases, the development of the CRMF Plan for mangrove management highlights the need for limited harvesting of mangroves as an incentive for community long-term management of a given area.

Reforestation through the Fishery Sector Program

Between 1991 and 1994, the Department of Agriculture and DENR collaborated on the FSP initiative on mangroves. Initially, replanting was accomplished by contracting local communities to plant seedlings and young trees. This system had many problems. In 1991, only 6,900 ha was reforested, well below the target of 30,000 ha. It was replaced by a more community-based management system with NGO assistance. Although targets were not achieved, FSP recognized that the latter system of involving the community directly is a more sustainable approach to reforestation and maintenance of existing resources (FSP 1996).

Local Government and Community Involvement in Management

In the Philippines, some, but not all, coastal communities near mangrove areas are aware of their resource value. They associate the health of fisheries with the health of mangrove ecosystems and realized that fishpond development has taken its toll on natural

[2] This is equivalent to P32,400/ha/year at the exchange rate of $1 = P54, as of July 2003.

Endangered Chinese egrets (*Egretta eulophotes*) roosting on a mangrove (*Rhizophora*) in Olango Island Wildlife Sanctuary, Cebu, Philippines.

productive benefits of fish, shrimp, wood and other products.

As early as 1964, some mangrove rehabilitation efforts were initiated in Bohol Island, Visayas. One community in Getafe reforested 100 ha. Another reforestation project by students and school officials in Calape, Bohol, in 1968 planted a 20-m band along the 4.8 km coast for protection against wind and storm waves (Yao 1986). Also, controlled harvesting of mangroves for firewood and poles has long been a practice by people who purposely thin the mangroves to make them grow more efficiently. This type of harvesting is seen as an incentive for community groups to enter into agreements for management.

Learning from earlier community projects, the Central Visayas Regional Project (1984-1992) experimented with the provision of secure tenure to one individual or family in return for maintaining an area as a healthy forest. This arrangement was called a stewardship agreement. It was initially used to promote reforestation in open areas because the national policy at that time would not allow small hold management of existing mangroves. Although mangrove planting progressed rapidly, long-term success rates were less than 50% because information on methods and sites was lacking. Also, planting outside of natural mangrove habitat predisposed efforts to failure. Another limitation was the lack of suitable planting material, which consequently led to single species dominance in newly planted areas (Vande Vusse, pers. comm.).

The initial experiments in stewardship agreements were followed by the contracting of individuals and groups to plant mangroves. When communities were directly responsible with stewardship agreements, the cost/ha was about $80. Contracting individuals without any community organization or volunteer labor increased the cost to more than $400/ha. In addition, the communities participated in the exercise primarily to make money more than to enhance the environment. The success rate was much less than 50%.

In 1991, the management of existing, but degraded mangrove forest, began using a mangrove stewardship agreement at Cogtong Bay, Bohol Island. Designated seed trees were allowed to grow while others were harvested for fuelwood and poles. Forest quality and the abundance of naturally occurring seedlings increased. The need to stop fishpond development was highlighted through community opinion and resistance to fishpond development in the area. This success has encouraged DENR to increase its focus on the rehabilitation and management of existing forest in its programs through community involvement (Janiola 1996; Vande Vusse, pers. comm.).

The Buswang Mangrove Reforestation Project in Kalibo, Panay Island, has been particularly successful. Here, the government contracted the Kalibo Save the Mangrove Association, an organization with 26 family beneficiaries, to replant 50 ha. Four years after the project started in 1990, the organization was able to harvest and earn from the *Nipa* leaves on 5 ha of the area. DENR awarded the organization with a 25-year Forest Land Management Agreement in 1995 (Primavera and Agbayani 1996).

Finally, the Coastal Resource Management Project (CRMP) of DENR assisted LGUs in their mangrove management efforts from 1997 through 2001. The important outcome of this project, that builds on the community focus of DENR, is that CBFMAs were awarded to 9 POs with 620 members. These 9 CBFMAs cover 3,414 ha of mangrove habitat in Bohol (CRMP 2003). A guide for monitoring and evaluating CBFMAs was also developed and tested and is being used by DENR as its primary means of evaluating CBFMA performance (Melana *et al.* 2000; CRMP 2003).

New Policies Support Sustainable Use and Management

In view of all that has been learned from the past experiences, the following policy directions are suggested:

- Priority must be given to saving and managing existing forest and habitat. The basic biophysical and environmental factors that support mangrove ecosystem growth and sustenance must be considered in all project areas.
- Individuals and groups at community level must strengthen their will and capacity to protect and use the resource wisely. This requires a lengthy process of community organization and training

with support from government, NGO and other assisting organizations using integrated approaches. The assisting organizations should have a full-time, live-in presence in the coastal area. They should take responsibility for community organization, training and facilitation of community roles in management activities.

- CBFMAs shall be used to promote local responsibility in maintaining permanent mangrove forested areas. These should allow limited but sustainable use in some cases to promote forest succession and provide economic incentives to local community managers. The DENR will monitor each CBFMA area for compliance with the management plan.
- Areas released for fishpond purposes but are not used for that purpose and do not meet certain criteria should be reverted to DENR for mangrove rehabilitation.
- An area management approach requires that all mangrove resources be included in the management plans for any given area regardless of the previous classifications.
- Sanctuaries may be established over mangrove areas as determined by local communities with guidance from DENR or BFAR and the legal support of local government.
- The DENR and other government personnel should provide technical assistance but not take full responsibility for field achievements.
- Accurate mapping of mangrove resources and the immediate uses of land such as for fishponds should be the responsibility of DENR and BFAR working with LGU.
- LGUs will lead or participate in community planning and assist to coordinate with other government services.

Conclusion

The Philippines has lost much of its mangrove resources to other uses. The downward trend has prompted many experiments in community-based and cooperative management guided by local and national government agencies. The CBFMA system is becoming effective in stabilizing mangrove resources in some areas in the country. Successful tests have been implemented on the islands of Bohol and Panay and in selected other communities. These successes emphasize the need to minimize discrepancies between national law and the practice of sustainable use to encourage community participation and stewardship.

While the government ceased approving mangrove conversion to fishpond and is considering increasing economic rent for leases, illegal conversion still occurs in some areas. But, where communities have been organized and given responsibility for management, degradation has slowed or stopped. Consequently, the promotion of CBFMAs is a primary tool in protecting mangrove resources. It is also intended that as integrated coastal resource management plans are developed for particular areas, all mangrove resources and habitat areas will be included and targeted for sustainable use in their original state.

It is also important that national economic policies be improved to encourage enhanced management of mangroves. The total gain to the Philippines for protecting its remaining mangrove ecosystem is substantial. Using the conservative estimate of value from direct benefits of $600/ha/year, the country gains at least $83 million/year in fish production and potential sustainable wood harvest from the existing 138,000 ha. If we could increase the area of healthy mangrove forest to 200,000 ha, the annual natural benefits would potentially increase to $120 million for a gain of about $37 million/year (White and Cruz-Trinidad 1998). This is indeed a good investment!

Acknowledgments

The contributions and assistance from Dr. Fred Vande Vusse, Ms. Betty Dar (DENR) and Mr. Sonny Gendrano (DENR) are acknowledged. The references of Dr. J.H. Primavera and D.M. Melana were very helpful.

Bibliography

ADB (Asian Development Bank). 1993. Fisheries sector profile of the Philippines. ADB, Manila, Philippines.

Brown, W.H. and A.F. Fischer. 1918. Philippine mangrove swamps. Department of Agriculture and Natural Resources. Bur. Fish. Bull. No. 7.

CRMP (Coastal Resource Management Project). 2003. 2002 annual report. Coastal Resource Management Project, Cebu City, Philippines.

DENR (Department of Environment and Natural Resources). 1988. Mapping of the natural conditions of the Philippines, final report. Swedish Space Corporation, Solna, Sweden.

DENR (Department of Environment and Natural Resources). 1989. Philippine strategy for sustainable development. DENR, Quezon City, Philippines.

Dixon, J.A. 1989. Valuation of mangroves. Trop. Coast. Area Manage. 4 (3): 1-6.

FSP (Fishery Sector Program). 1996. Executive summary: Fisheries Sector Program review. PRIMEX, Inc., Pasig City, Philippines.

Janiola Jr., E.S. 1996. Mangrove rehabilitation and coastal resource management in Cogtong Bay: Addressing mangrove management issues through community participation, p. 49-65. *In* E.M. Ferrer, L. Polotan-de la Cruz and M. Agoncillo-Domingo (eds.) Seeds of hope: A collection of case studies on community-based coastal resource management in the Philippines. University of the Philippines-College of Social Work and Community Development, Quezon City, Philippines.

Melana, D.M., J. Atchue III, C.E. Yao, R. Edwards, E.E. Melana and H.I. Gonales. 2000. Mangrove management handbook. Department of Environment and Natural Resources, Quezon City, Philippines, through the Coastal Resource Management Project, Cebu City, Philippines.

NMRC (Natural Resources Management Center). 1978. Mangroves forests: Problems and management strategies. Likas-Yaman, J. Nat. Resour. Manage. For., 48 p. Ministry of Natural Resources, Manila, Philippines.

Primavera, J.H. and R.F. Agbayani. 1996. Cooperative strategies in community-based mangrove rehabilitation programs in the Philippines. Paper presented at the Ecotone V: Community Participation in Conservation, Sustainable Use and Rehabilitation of Mangroves in Southeast Asia, 8-12 January 1996,Ho Chi Minh City, Vietnam.

Schatz, R.E. 1991. Economic rent study for the Philippines Fisheries Sector Program. Asian Development Bank. TA 1208-PHI, Mandaluyong City, Philippines. 42 p.

White, A.T. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines, 96 p.

World Bank. 1989. Philippines: Environment and natural resources management study. World Bank, Washington DC, USA.

Yao, C.E. 1986. Mangrove reforestation in Central Visayas. Canopy Int. 12: 6-9.

Seagrass Ecosystem of the Philippines: Status, Problems and Management Directions[1]

MIGUEL D. FORTES[2]
KRISTINE F. SANTOS[3]
[2]Marine Science Institute; [3]Institute of Environmental Science and Meteorology
College of Science, University of the Philippines
Diliman, Quezon City 1101
Philippines

Introduction

Seagrass beds are a discrete community dominated by flowering plants with roots and rhizomes, thriving in shallow coastal waters. They slightly reduce sediments and normally exhibit maximum biomass under conditions of complete submergence (Fortes 1995). Seagrass meadows support a rich diversity of species from adjacent systems and provide primary refuge for both economically and ecologically important organisms. Seagrasses are sensitive to environmental fluctuations. Species coming from neighboring systems encounter "marginal conditions" and are at the extremes of their tolerance levels to environmental alterations in seagrass habitats. This sensitivity makes seagrasses useful indicators of changes not easily observable in either coral reefs or mangrove forests. Fortes (1995, 1990) has reviewed the seagrass resources of East Asia, discussing their status and potential as a resource, as well as their environmental roles and prospects for management.

Public and scientific attention has focused on seagrasses due to the documentation of human influence on the worldwide decline of this vegetation and the increased awareness of the importance of seagrasses as coastal habitat (Phillips 1960; Orth and Moore 1983). Monitoring seagrass is rapidly becoming one of the foremost methods to determine the overall health and condition of the aquatic environments. Issues affecting their distribution and health need to be identified and addressed. This is because of their extreme importance as coastal ecosystems that continue to be impacted by issues related to burgeoning human populations (Avery 2000; Bortone and Turpin 2000).


M. Gasalatan

Fisher conducting participatory coastal resource assessment of seagrass beds, using a quadrat to sample the quality of seagrasses.

Seagrass Resources

The Philippines, with its 18,000 km coastline, has sizable seagrass areas spread discontinuously along the shallow portions of its coastlines. Sixteen species that have been identified (Fortes 1986) are variably distributed in all parts of the country. The number of species present appears to be largely a function of the extent of studies made and the length of the coastline. From surveys in 96 sites, a total of 978 km^2 of seagrass beds have been identified in the country, mostly in northwestern, western and southern portions, with outlying islands having sizable beds. A significant portion of the coastal habitats is at high risk of being lost in the next decade. About half have either been lost or severely degraded during the past 56 years (Chou 1994; Fortes 1994), and the rate of degradation is increasing.

---

[1]This paper can be cited as follows: FORTES, M.D. and K.F. SANTOS. 2004. Seagrass ecosystem of the Philippines: Status, problems and management directions, p. 90-95. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 1. Initial estimates of the area (km^2) of seagrass beds in the Philippines (combined satellite images and ground truth surveys).

Region	Province	Location	Latitude (°N)	Longitude (°E)	Area (km^2)
I	Pangasinan	Cape Bolinao	16.40	119.88	25
II	Cagayan	Cape Engaño/Escarpada Pt.	18.45	122.28	9
II	Cagayan	Fuga	18.83	121.33	3
II	Isabela	Divilacan Bay/Palanan Bay	17.28	122.42	5
IV	Marinduque	Calancan Bay	13.55	121.92	7
IV	Oriental Mindoro	Puerto Galera	13.45	120.95	9
IV	Palawan	Bacuit Bay	10.72	119.50	11
IV	Palawan	Bugsuk Island	8.23	117.40	12
IV	Palawan	Malampaya Sound	11.17	119.40	21
IV	Palawan	Puerto Princesa/Honda Bay	9.85	118.93	43
IV	Palawan	Ulugan Bay	10.10	118.77	11
IV	Quezon	Calauag Bay	14.02	122.17	9
IV	Quezon	Polillo Island	15.03	121.80	13
IV	Quezon	Ragay Gulf	13.23	122.70	14
V	Sorsogon	Sorsogon Bay	12.77	123.25	17
VI	Negros Occidental	Bais Bay	10.57	123.15	9
VII	Bohol	Northern Bohol	10.15	124.43	19
VII	Negros Oriental	Apo Island	9.02	123.32	7
VIII	Samar	Catbalogan area	11.73	127.95	11
X	Camiguin	Mantigue	9.08	124.78	9
X	Misamis Occidental	Baliangao	8.70	122.63	7
X	Misamis Occidental	Lopez Jaena	8.63	123.77	16
X	Misamis Oriental	Naawan	8.62	124.38	9
XI	Davao	Samal Island	6.88	125.78	17
XI	Davao Oriental	Mati	6.83	126.28	17
XIII	Surigao del Norte	Dinagat Sound	9.87	125.68	12
Total					**343**

Of the total area identified thus far, 343 km^2 have been estimated using combined satellite images and ground truth surveys. On the other hand, 635 km^2 are gross estimates from satellite images only (involving no ground truth surveys) as the places are clusters or parts of big islands, and they cannot be delimited by single grids (Tables 1 and 2).

Seagrass Decline

Studies on seagrasses by institutions contracted under the Fisheries Sector Program (viz., Calauag Bay, Carigara Bay, Lagonoy Gulf, Manila Bay, Ormoc Bay, Panguil Bay, Ragay Gulf, San Miguel Bay, San Pedro Bay, Sogod Bay, Sorsogon Bay and Tayabas Bay) and the Fisheries Resource Management Project (viz., Lingayen Gulf, Puerto Princesa Bay, Honda Bay, Sapian Bay, Gingoog Bay, Davao Gulf and Butuan Bay) of DA-BFAR showed that aside from natural causes, anthropogenic impacts are the primary cause for most of these losses and these are increasing as human population increases. In the Philippines, a substantial number of people dwell close to shallow bays, lagoons and islands fringed by seagrass beds. There is rapid economic and human population growth, the latter projected to double in the next 25-35 years (WRI 1990). The total population of the Philippines as of May 2000 was 76.5 million, an increase of 7.9 million (11.5%) over the 1995 figure of 68.6 million. Total fish required for food in 2005 at current per capita consumption would

Table 2. Additional areas where gross estimates were made from satellite images only.

Location	Area (km^2)
Northern Palawan	89
Spratlys	22
Sulu Archipelago	167
Hundred Islands	31
Panay Island	42
Southwestern Palawan	47
Pacific coast of Sorsogon Province	41
Malangas Bay	17
Sarangani Islands	19
Batanes Islands	21
Calatagan Peninsula	11
Rest of Batangas Province	22
Rest of Marinduque	33
Southern Zamboanga	25
Siquijor	21
Lingayen Gulf (southern and eastern)	14
Total	**635**

Figure 1. Overfeeding in fish cages leads to eutrophication.

be 3.5 million t per year. The Philippines will have one of the highest rates of consumption (Silvestre and Pauly 1997). These figures imply that tremendous pressure on the coastal habitats and resources will be applied to meet the projected demand.

Coastal eutrophication (Figure 1) is the major long-term threat to seagrass ecosystems around the world. A particular problem in embayments with reduced tidal flushing, nutrient loading or eutrophication results from wastewaters which reach the coasts from industrial, commercial and domestic facilities, inadequate septic systems, boat discharge of human and fish wastes, and storm drain runoff carrying organic waste and fertilizers. The direct impact is the enhancement of growth in many plant forms resulting in reduction of light. Ultimately, the cause of nutrient loading along the coasts is increasing population density. Environmental effects of land-based activities in the Philippines are only moderately studied. The same is true for studies on the status and use of seagrass beds and quantification of the pollutants that affect them. Nevertheless, most of the environmental problems associated with the beds and measures to mitigate them are known. Despite such knowledge, however, these problems remain insufficiently addressed. It is interesting to note that in the past 10 years, the environmental conditions remain basically the same, although awareness on the importance of seagrasses has substantially increased.

Table 3 gives a summary of current knowledge about seagrass habitats (and associated environmental problems) in the Philippines compared to selected coastal states in East Asia.

Coastal environmental problems exerting the most severe impact in Southeast Asia (including the Philippines) during the past decade are given in Table 4. They are ranked in order of priority (1 to 12) and classified according to urgency, i.e., immediate, short-term (within the next five years) and long-term (within the next 10 years or more).

Interestingly, the current priority coastal environmental problems in the region remain basically the same and are projected to remain so until the year 2020. Such scenario is reflected in the results of a recent consultation with Southeast Asian experts held in Hanoi on 1-4 March 2002 under the Global International Waters Assessment Project. The results of the consultation focused on five most important environmental concerns (Table 5). Infrastructure development is doubling at almost decadal rates. These changes are resulting in greater demands for coastal zone resources.

Management Directions

Impediments to addressing the threats

A host of factors impede the mitigation or resolution of threats to seagrass habitats. These include: lack of trained seagrass researchers; limited scope and largely descriptive nature of existing work; gaps in basic knowledge; lack of appreciation of the resources; limited and uncoordinated work among research institutions; misguided management efforts; lack of law enforcement; lack of effective management and research linkages; and nonconsideration of the social and cultural dimensions relevant to seagrass use and management.

The Philippines in particular is confronted by the lack of effective linkages between science institutions (scientific production) and productive sector (industry application). Other obstacles which are projected to persist include: shortage of research funds; low staff salaries; lack of access to needed technologies; weak

Table 3. Status of information about seagrass habitats in the Philippines and other Asian countries.

Country	Species	A	B	C	D	E
Australia	30	XXX	XXX	XX	XXX	XXX
Philippines	**16**	**XX**	**XX**	**XX**	**XX**	**XXX**
Vietnam	15	X	X	XX	XX	XX
Indonesia	13	X	XX	XX	XXX	XXX
Malaysia	12	X	X	X	XX	XX
Thailand	12	X	X	X	X	XX
Singapore	7	X	X	X	XX	XXX
Cambodia	6	X	X	XX	XX	X
China	3	X	X	XX	XX	XX

Legend:
A: extent of the major beds that may be affected.
B: status and uses of the beds.
C: quantification of the loads of sediments, nutrients, organic materials and toxic chemicals affecting the beds.
D: identification of other related environmental problems.
E: whether there is a cure of the problems in place.
The state of knowledge on the parameters are described arbitrarily according to the following scale:
xxx: well-studied. xx: moderately studied. x: not studied/implemented; plans exist.

Table 4. Coastal environmental problems in Southeast Asia (UNEP 1990).

Problem	Immediate	Short-term	Long-term
Habitat destruction***	1	1	1
Sewage pollution***	2	2	3
Industrial pollution***	3	3	2
Fisheries overexploitation***	4	4	6
Siltation/sedimentation***	5	5	4
Oil pollution**	6	6	8
Hazardous waste*	7	7	7
Agricultural pollution**	8	8	5
Red tides*	9	9	11
Coastal erosion**	10	10	10
Natural hazards*	11	12	12
Sea level rise*	12	11	9

Severity of impact on seagrass beds: *** - severe impact; ** - moderate impact; * - slight or no impact.

Table 5. Priority coastal environmental problems in Southeast Asia, 2001-2020.

Problem	2001		2020	
	Severity	Rank	Severity	Rank
Habitat and community modifications***	3	1	3	1
Unsustainable exploitation of fisheries and other living resources***	3	1	3	2
Pollution***	2	3	3	2
Freshwater shortage*	2	4	3	4
Global change*	1	5	1	5

Severity: *** - severe impact; ** - moderate impact; * - slight or no impact. Importance rank: 1 - highest, 5 - lowest.

technical support infrastructure; poor public appreciation of coastal resources and the environment; and relatively small number of human resource trained in promoting integrated management approaches. The lack of national commitment to support and encourage the development of marine science remains as a major impediment.

Ways forward

Key directions in seagrass research, development and management, given the trend of coastal habitat destruction in the Philippines, include the following:

- *Focus research on priority management issues.* Understand seagrasses and impacts on them utilizing scientific information; use such knowledge to bring about positive changes in management approaches and solutions to reverse seagrass degradation and loss.
- *Undertake more studies on priority issue-oriented parameters.* There is a dearth of data on the current status of seagrasses in the Southeast Asian region in general. Meager data exist on siltation, pollution and chemical runoff into rivers and water bodies that drain into seagrass beds. Data on key biological and human environment indicators need to be collected to guide policy and set parameters for sustainable resource use.
- *Develop an integrated framework for action: putting our acts together.* The International Seagrass Biology Workshop series has identified the essential elements to conserve and sustainably utilize the seagrass resources of the world. These elements consist of: (1) needed linkages among seagrass scientists and practitioners from all parts of the world; (2) mechanisms to ensure access and transmission of data and information; (3) sustained research activities on the dynamics of the ecosystem; and (4) modest support from academic and funding institutions. The Seagrass Monitoring Project (*Seagrass*Mon) and Seagrass Network (*Seagrass*Net) were operationalized to implement the plan of action for seagrass research and monitoring. Approved at the Third International Seagrass Biology Workshop in the Philippines (1998), the Charter for Seagrasses has been adopted, laying the principles that guide research and development of seagrasses in the world.
- *Undertake economic valuation of resources and relevant policy changes.* Market-based approaches to environmental regulation will only be successful if they reflect the users' preferences as individuals, both nationally and internationally (Garrod and Willis 1999). Valuation of resources and of benefits of policy change relative to these resources is thus extremely important.
- *Use available scientific knowledge and forge public-private partnerships.* It is necessary to use relevant scientific information that is currently available in order to manage seagrass resources sustainably. Such knowledge should inform of conservation strategies at the local, national and regional levels. Partnerships among and between government organizations at international, regional, national and local levels, and the private sector should be established.
- *Ensure functional coordination among concerned agencies.* At present, the Philippines and countries in the region are not gaining the full value of lessons learned from policy successes and failures. Concerted actions among mandated agencies are needed to protect the coasts, and to: (1) eliminate duplication of effort, and save and invest funds more wisely; (2) illuminate areas of research cooperation between agencies and academia; (3) facilitate the development of information systems that would serve not only management agencies but also the public; and (4) provide forums for discussion, which are open to all.
- *Increase the amount of information about seagrass in existing databases.* There is much information available in scientific literature that is not part of any database and thus not readily accessible. Such information could be useful in the generation of habitat conservation plans and other ecosystem management strategies. The information content of the data repositories should be increased, and this can be done by allocating certain portions of research funding for long-term management of information generated.

M. Gasalatan

Researchers conducting assessment of seagrasses and the organisms living within the seagrass bed at low tide.

- *Adopt the integrated coastal area management (ICM) philosophy.* The overall goal of ICM is to improve the quality of life of human communities who depend on coastal resources while maintaining biological diversity and productivity of coastal ecosystems. Adoption of the ICM philosophy (and its corresponding planning and management framework) is essential to long-term sustainable use and conservation of the seagrass resources of the country.

References

Avery, W.M. 2000. Monitoring submerged aquatic vegetation in Hillsborough Bay, Florida, p. 137-145. *In* S.A. Bortone (ed.) Seagrasses: monitoring, ecology, physiology and management. CRC Press, Boca Raton, Florida.

Bortone, S.A. and R.K. Turpin. 2000. Tape grass history metrics associated with environmental variables in a controlled estuary, p. 65-79. *In* S.A. Bortone (ed.) Seagrasses: monitoring, ecology, physiology and management. CRC Press, Boca Raton, Florida.

Chou, L.M., Editor. 1994. Implications of expected climate changes in the East Asian Seas region: an overview. RCU/EAS Tech. Rep. Ser. No. 2. UNEP, Bangkok.

Fortes, M.D. 1986. Taxonomy and ecology of Philippine seagrasses. University of the Philippines, Quezon City, Philippines. 245 p. Ph.D. dissertation.

Fortes, M.D. 1990. Seagrass resources in East Asia: Research status, environmental issues and management perspectives, p. 135 144. *In* ASEAMS/UNEP Proceedings of the First ASEAMS Symposium on Southeast Asian Marine and Environmental Protection. UNEP, Bangkok. UNEP Reg. Seas Rep. Stud. No. 116, 93 p.

Fortes, M.D. 1994. Status of seagrass beds in ASEAN, p. 106-109. *In* C.R. Wilkinson (ed.) ASEAN-Australia Symposium on Living Coastal Resources, 3 October 1994, Bangkok, Thailand. Consultative Forum. Living coastal resources of Southeast Asia: Status and management report. AIMS, Australia.

Fortes, M.D. 1995. Seagrasses of East Asia: Environmental and management perspectives. RCU/EAS Tech. Rep. Ser. No. 6: 75 p. UNEP, Bangkok.

Garrod, G. and K.G. Willis. 1999. Economic valuation of the environment: Methods and case studies. Edward Elgar, Cheltenham, UK. 384 p.

Orth, R.J. and K.A. Moore. 1983. Chesapeake Bay: An unprecedented decline in submerged aquatic vegetation. Science 222: 51-53.

Phillips, R.C. 1960. Observations on the ecology and distribution of the Florida seagrasses. Prof. Pap. Ser. 2. Florida State Board of Conservation Marine Laboratory, St. Petersburg, Florida, USA.

Silvestre, G. and D. Pauly. 1997. Management of tropical coastal fisheries in Asia: An overview of key challenges and opportunities, p. 8-26. *In* G. Silvestre and D. Pauly (eds.) Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

UNEP (United Nations Environment Programme). 1990. Report of the Fourth Meeting of Experts on the East Asian Seas Action Plan, 3-6 December 1990, Quezon City, Philippines. UNEP (OCA)/EAS WG 4/6. UNEP OCA/PAC, Nairobi.

WRI (World Resources Institute). 1990. World resources 1990-91. Oxford University Press, New York, USA.

Status of Water Quality in Philippine Coastal and Marine Waters[1]

MARIA LOURDES SAN DIEGO McGLONE
GIL JACINTO
IMELDA VELASQUEZ
DAISY PADAYAO
Marine Science Institute, University of the Philippines
Diliman, Quezon City
Philippines

Introduction

Coastal marine waters support dynamic ecosystems, contain valuable natural resources and have environmental values important to the coastal community. In the Philippines, the inseparable relationships between land use and water quality are major issues in the coastal zone. Marine water quality, or the observed intrinsic characteristics of marine waters affecting their ability to support life or facilitate biological processes, has been linked to problems such as eutrophication, contaminants and harmful algal blooms. This review is an initial attempt to assess the country's water quality status using data from 12 bays, all known fishing grounds, in the Philippines. The data used are part of the resource and ecological assessment of 12 priority areas in the country (1992-1996), an initiative of the Fisheries Sector Program (FSP) of the Bureau of Fisheries and Aquatic Resources (BFAR 1992a-d, 1993, 1994a-b, 1995a-d, 1996). To provide a perspective on the historical changes in water quality conditions, two case studies are presented: Manila Bay, a system affected by increasing human population and Lingayen Gulf, specifically Cape Bolinao, a coastal area influenced by the proliferation of finfish mariculture activities. Emergent issues and key management directions are likewise explored.

Important Water Quality Parameters

The key indicators commonly used to describe water quality characteristics can be classified into two broad groups. The first includes those linked to high organic load, namely: nutrients, dissolved oxygen (DO), chlorophyll-a and total suspended solids (TSS). Nutrients in excess can lead to increased algal growth resulting in eutrophic water conditions. The die-off of algal blooms translates to increased organic material, which requires more DO for decomposition. Low DO levels may serve as an indicator of eutrophic conditions. One adverse consequence of very low DO experienced in coastal waters is fish kill. Chlorophyll-a is a measure of algal biomass. Besides eutrophication, increased algal growth can reduce water clarity and cause shading of bottom plants, thus reducing normal photosynthetic activity in the benthic community. Moreover, algae can cause health concerns specifically for those associated with the release of toxins. High TSS may be a result of algal growth, or increased silt and clay. Increased TSS can limit the penetration of light, again reducing photosynthesis in the benthic community. Furthermore, particulate material can smother sessile benthic organisms and provide habitats for harmful bacteria and viruses.

The second group of indicators includes those that could have a more direct effect on humans; these are heavy metals, pesticides and fecal coliform. Heavy metals affect the biota through their ability to bioaccumulate, move up the food chain and ultimately are consumed by humans. The persistence of pesticides, an important factor to determine their impact on nontarget species, is oftentimes closely associated with food chain magnification. Both heavy metals and pesticides are of concern due to toxicity issues and potential carcinogenic effects. The level of fecal coliform, or pathogens from fecal material, is

[1] This paper can be cited as follows: MCGLONE, M.L.S.D., G. JACINTO, I. VELASQUEZ and D. PADAYAO. 2004. Status of water quality in Philippine coastal and marine waters, p. 96-108. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 1. Criteria value of water quality indicators.

Parameter	Criteria Value	Use Classification	Source
Dissolved oxygen	5 mg/L	SC	DAO-34
Nitrite	3.95 µM	*	ASEAN-Canada
Nitrate	4.29 µM	*	ASEAN-Canada
Ammonia	5 µM	*	ASEAN-Canada
Phosphate	0.48 µM	**	ASEAN-Canada
Chlorophyll-a	10 µg/L	*	ASEAN-Canada
Total suspended solids	50 mg/L		Malaysian standard
pH	6-8.5	SC	DAO-34
Heavy metals			
Copper	2.9 µg/L	*	ASEAN-Canada
Cadmium	0.01 mg/L	SC	DAO-34
Lead	0.05 mg/L	SC	DAO-34
Zinc	50 µg/L	*	ASEAN-Canada
Chromium	0.1 mg/L	SC	DAO-34
Fecal coliform	200 MPN/100 ml	SB	DAO-34

Class SB - for primary contact recreation.
Class SC - for propagation and growth of fish and other aquatic resources.
* - for protection of aquatic life.
** - for protection of coastal aquatic life.

critical in areas used for primary (swimming) and secondary (fishing) contact activities. Another water quality parameter, pH, may not be entirely useful for marine waters due to the ability of seawater to buffer pH changes. Nonetheless, either very acidic or very basic conditions will not support life.

Status

The quality of marine coastal waters in the 12 FSP bays was assessed relative to allowable indicator levels set as regulations. In the Philippines, the Department of Environment and Natural Resources (DENR) Administrative Order (DAO) No. 34 (Series of 1990) (DENR 1995) has provided a basis for appraising water quality using some physico-chemical indicators (DO, fecal coliform, some heavy metals and pesticides, pH). For the other indicators, the proposed marine environmental quality criteria of the Association of Southeast Asian Nations (ASEAN) (McPherson *et al.* 1999) were used for nutrients and chlorophyll-a, and the Malaysian standard (PEMSEA 2001) for TSS. Table 1 presents the criteria for indicators used in assessing water quality conditions.

The status of water quality in the 12 FSP bays was evaluated based on "exceedance" of reported concentrations from the criteria value. Seven of the 12 study sites are in Luzon (Manila Bay, Calauag Bay, Tayabas Bay, San Miguel Bay, Ragay Gulf, Lagonoy Gulf, Sorsogon Bay), 4 in the Visayas (Carigara Bay, San Pedro Bay, Ormoc Bay, Sogod Bay) and 1 in Mindanao (Panguil Bay) (Figure 1). Water quality in Lingayen Gulf, Pacific Seaboard and South China Sea was included in the assessment (Figure 1). Since most of the study sites reported levels during the different monsoons, except for Panguil Bay, which had annual averages, water quality was evaluated per monsoon period. Although available, data for Tayabas Bay were not included in the assessment due to an unresolved question on the units of concentration reported. Majority of the sites was surveyed during the southwest (SW) monsoon and summer months, with fewer observations during the northeast (NE) monsoon.

Table 2 shows the range of values of water quality indicators for the different study sites. Nonuniformity in how data were reported resulted in large discrepancy in number of observations among sites. Data were presented as number of single observation (n^1), monthly mean of all stations (n^2), annual mean per station (n^3) or monthly depth-average per station (n^4). Data from the upper 10% of the water column depth, or the entire water column for shallow depths, were utilized in the assessment. This upper layer is the most affected by inputs from land, and where most biological life is sustained.

In general, the upper layers were within the allowable limit (not exceeding the criteria values). However, significant variation in concentration of some parameters was observed for some bays during different periods of the year. Table 3 presents an assessment of values relative to the criteria, given as percent of data within the allowable limit, and percent that exceeded the limit. The DO concentrations during the NE monsoon were above the 5.0 mg/l criteria except for Ormoc Bay where about 80% of the measured concentrations were below the allowable limit. During the SW monsoon, 100% of DO in Ormoc Bay, and 40 to 50% in Ragay Gulf, San Miguel Bay and Lingayen Gulf were less than 5.0 mg/l. In summer, about 80% of DO values in Ragay Gulf were below 5.0 mg/l.

Among the nutrients, phosphate was noticeably high at the study sites. In Manila Bay and Ragay Gulf, about 80% of the phosphate concentrations exceeded the allowable limit during summer. The values in Manila Bay may have reflected domestic and agricultural wastes in the river since majority of the sampling sites was near major tributaries. In San Pedro Bay, 100% of the values exceeded the allowable limit throughout the year. This was also true for 80% to 100% of ammonia values during the NE monsoon and summer.

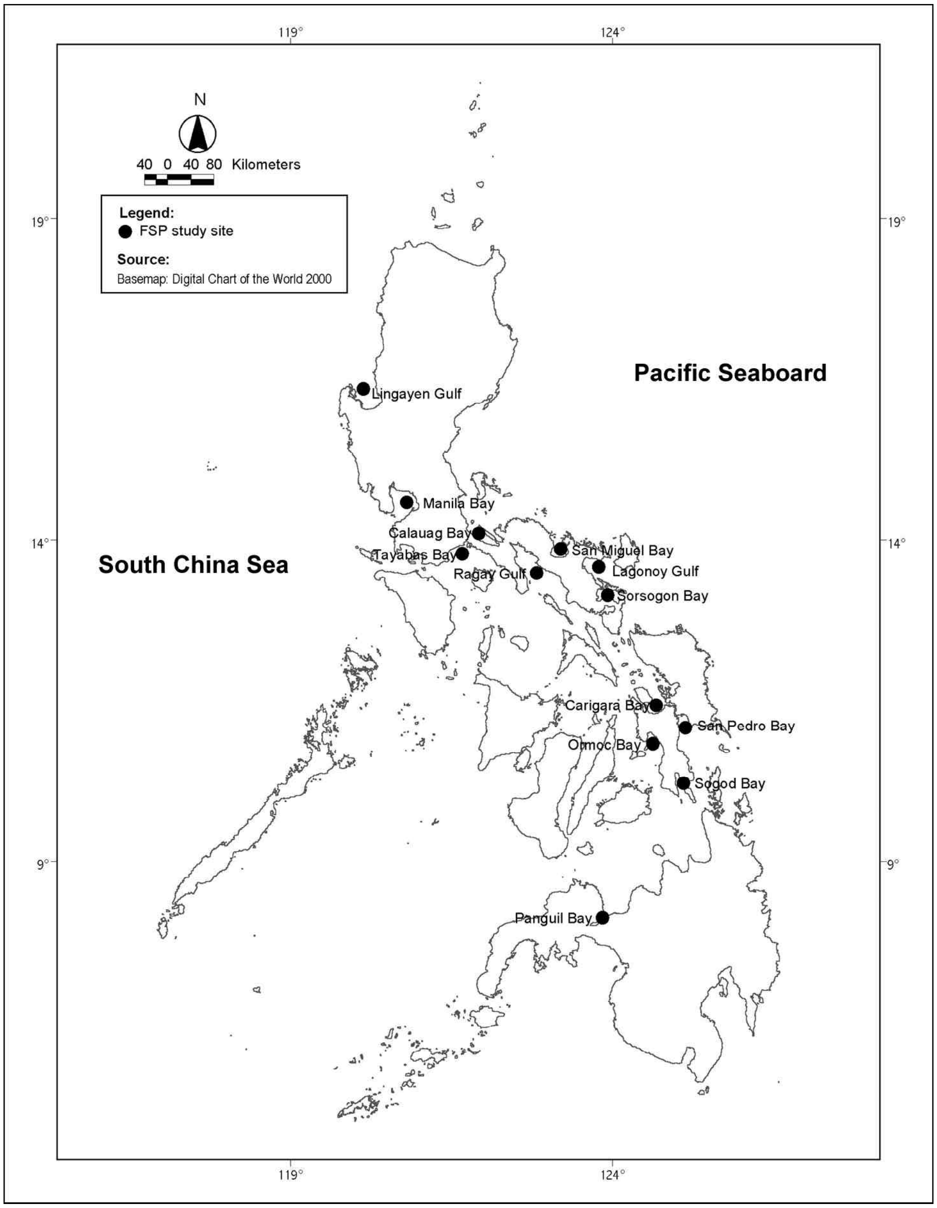


Figure 1. Map of the Philippines showing the study sites for water quality.

The high levels in San Pedro Bay were observed in areas near human settlements where waste discharges are carried by surface runoffs through the numerous river systems along the western and northern sections of the bay. For nitrate, 80% of the concentrations in Sorsogon Bay exceeded the criteria during the NE monsoon, and over 90% during summer in Ragay Gulf. For nitrite, the study areas were generally within the allowable limit except in Sorsogon Bay during the NE monsoon and in Lingayen Gulf and Manila Bay during the SW monsoon, where 40%, 5% and 10% of concentrations exceeded the criteria, respectively. Based on annual mean values, phosphate and ammonia concentrations in Panguil Bay exceeded the allowable limit. There may have been a bias in the assessment since data used were presented as annual averages for each sampling station.

For chlorophyll-a, 10%, 25% and 27% of concentrations in Lingayen Gulf exceeded the criteria during the NE monsoon, summer and SW monsoon, respectively. The data from Lingayen Gulf included those from Bolinao and Dagupan with their attendant environmental concerns related to mariculture plus the influence of river runoff. About 11-13% of chlorophyll-a values in Manila Bay were beyond the allowable limit.

In Lingayen Gulf, 10% of TSS values during the NE monsoon, and 15% during the SW monsoon exceeded the allowable limit. In Lagonoy Gulf, 30% and 10% of TSS concentrations were beyond the allowable limit during the NE monsoon and summer,

Table 2. Range of values of water quality indicators.[a]

Bays	Depth assessed	DO (mg/L)	Nitrite (µM)	Nitrate (µM)	Ammonia (µM)	Phosphate (µM)	Chl (µg/L)	TSS (mg/L)	F coliform (MPN/100 ml)	Zinc (ppm)	Mercury (ppm)	Copper (ppm)	Cadmium (ppm)	Lead (ppm)	Chromium (ppm)	pH
Lingayen Gulf	5 m															
n^1		76	145	104	150	150	148	148	17							31
min		2.1	0	0	0	0	0	0.5	20							7.2
max		8.5	6.07	19.74	42.84	6.53	164.75	651.5	16,000							8.5
Manila Bay	5 m															
n^1		51	222	188	209	218	55			10	10					
min		4.8	0	0	0.144	0.029	0			0.034	0.00004					
max		18.7	5.466	10.432	37.815	5.867	32.368			0.115	0.0014					
Calauag Bay	10 m															
n^1			57	57	19	57										
min			0.106	0	0.225	0.117										
max			0.576	3.442	3.789	0.358										
San Miguel Bay	2 m															
n^1		29	66	65	56	66		29	40			18	18	18		26
min		3.38	0.16	0.01	0.04	0.07		2	20			nd	nd	nd		6
max		7.23	0.7	5.34	6.49	1.54		360.6	51,500			0.1	0.07	0.9		7.8
Ragay Gulf	50 m															
n^1		53		53		53	62	35								53
min		3.8		0		0	0.02	2.2								7.16
max		6.1		24.1		3	0.33	31.9								8.2
Lagonoy Gulf	2 m															
n^1		141	40	40	40	40				22		66	65			146
min		5.36	0.1	0	0.021	0.05				0.01		nd	nd			6
max		12.28	1.105	10.9925	3.714	0.58				0.44		0.11	0.1			11.26
Sorsogon Bay	1 m															
n^1			14	46	44				18			35	35	36		
min			0	0.714	0.071				30			nd	0.01	0.05		
max			285.714	642.857	71.429				$35e^5$			0.13	0.06	0.46		
Carigara Bay	1 m															
n^1		60		60	60	58		227								60
min		5		0.1	0.07	0.01		12.55								7.25
max		7.4		10.56	15.4	2.2										8.75

Notes: min - minimum; max - maximum; n^1 = no. of single observation; n^2 = monthly mean of all stations; n^3 = annual mean per station; n^4 = monthly depth average per station.

Table 2 (cont.)

Bays	Depth assessed	DO (mg/L)	Nitrite (µM)	Nitrate (µM)	Ammonia (µM)	Phosphate (µM)	Chl (µg/L)	TSS (mg/L)	F coliform (MPN/100 ml)	Zinc (ppm)	Mercury (ppm)	Copper (ppm)	Cadmium (ppm)	Lead (ppm)	Chromium (ppm)	pH
San Pedro Bay	1 m															
n^2			11	11	11	11	8									
min			0.058	0.642	1.525	0.505	0.031									
max			0.243	1.136	17.525	1.684	0.363									
Ormoc Bay	10 m															
n^4		16	14	14		13	10									
min		4.35	0.02	0		0.01	0.04									
max		5.1	0.12	0.96		0.45	0.075									
Sogod Bay	10 m															
n^1		262		262	260	262	66									262
min		3.42		0.2	0.17	0.01	0.07									7.36
max		8.94		78.21	74	8.09	0.91									8.53
Panguil Bay	1-60 m															
n^3		6	11	11	11	11			$n^1 = 50$						$n^1 = 70$	11
min		5.55	0.079	0.134	34.636	1.196			0						nd	7.54
max		5.74	0.485	1.572	47.37	4.332			47						0.764	7.74
Pacific Seaboard	12 m															
n^1		35	42	42		43	42									
min		4.562	0	0		0										
max		7.149	0.462	6.353		1.439	1.023									
South China Sea	5 m															
n^1		17	7	14	14	15	17									13
min		6.2	0.08	0	0	0.76	0									6.4
max		6.9	0.43	1.23	0.54	2.56	0.33									8.29

Notes: min - minimum; max - maximum; n^1 = no. of single observation; n^2 = monthly mean of all stations; n^3 = annual mean per station; n^4 = monthly depth average per station.

Table 3. Assessment of water quality data relative to criteria value, given as % within allowable limit and % beyond allowable limit.

Bays	Assessment	DO	NH_3	NO_2	NO_3	PO_4	Chl-a	TSS	F coliform	pH
Northeast										
Lingayen Gulf	% within limit	100	98	100	100	63	90	90		
	% beyond limit	0	2	0	0	37	10	10		
	n	14	41	36	23	41	39	41		
Manila Bay	% within limit		98	100	100	71	88			
	% beyond limit		2	0	0	29	13			
	n		64	77	77	77	8			
Calauag Bay	% within limit		100	100	100	100				
	% beyond limit		0	0	0	0				
	n			18	18	18				
San Miguel Bay	% within limit	60	100	100	90	65		80	29	100
	% beyond limit	40	0	0	10	35		20	71	0
	n	15	20	20	20	20		15	14	13
Lagonoy Gulf	% within limit	100	100	100	100	100		70		100
	% beyond limit	0	0	0	0	0		30		0
	n	41	15	15	15	15		40		45
Sorsogon Bay	% within limit		45	57	14				11	
	% beyond limit		55	43	86				89	
	n		20	14	22				9	
San Pedro Bay	% within limit		25	100	100	0	100			
	% beyond limit		75	0	0	100	0			
	n		4	4	4	4	3			
Ormoc Bay	% within limit	17		100	100	100	100			
	% beyond limit	83		0	0	0	0			
	n	6		4	4	3	4			
Sogod Bay	% within limit	97	100		83	74				100
	% beyond limit	3	0		17	26				0
	n	69	69		69	69				69
Panguil Bay	% within limit								100	
	% beyond limit	none	none	none	none	none	none	none	0	none
	n								18	
Southwest										
Lingayen Gulf	% within limit	59	54	89	69	55	73	86	0	100
	% beyond limit	41	46	11	31	45	27	14	100	0
	n	29	56	56	29	56	56	56	10	18
Manila Bay	% within limit		84	98	97	32	89			
	% beyond limit		16	2	3	68	11			
	n		103	103	75	99	27			
Calauag Bay	% within limit		100	100	100	100				
	% beyond limit		0	0	0	0				
	n			18	18	18				
San Miguel Bay	% within limit	36	96	100	100	83		93	32	100
	% beyond limit	64	4	0	0	17		7	68	0
	n	14	26	30	30	30		14	22	13
Ragay Gulf	% within limit	61			57	89	100	100		100
	% beyond limit	39			43	11	0	0		0
	n	28			28	28	62	28		28
Lagonoy Gulf	% within limit	100	100	100	100	100		100		89
	% beyond limit	0	0	0	0	0		0		11
	n	70	10	10	10	10		114		71
Sorsogon Bay	% within limit		83		63				0	
	% beyond limit		17		38				100	
	n		24		24				9	
Carigara Bay	% within limit	98	85		90	92				23
	% beyond limit	3	15		10	8				78
	n	42	42		42	41				42

Table 3. (cont.)

Bays	Assessment	DO	NH_3	NO_2	NO_3	PO_4	Chl-a	TSS	F coliform	pH
Southwest										
San Pedro Bay	% within limit		100	100	100	0	100			
	% beyond limit		0	0	0	100	0			
	n		5	5	5	5	5			
Ormoc Bay	% within limit	100		0	0	0	0			
	% beyond limit	0		100	100	100	100			
	n	10		10	10	10	6			
Sogod Bay	% within limit	99	100		96	78				100
	% beyond limit	1	0		4	22				0
	n	69	69		69	69				69
Panguil Bay	% within limit								100	
	% beyond limit	none	none	none	none	none	none	none	0	none
	n								30	
Pacific Seaboard	% within limit	86		100	86	86				
	% beyond limit	14		0	14	14				
	n	7		7	7	7				
South China Sea	% within limit	100	75	100	100	100	100			100
	% beyond limit	0	25	0	0	0	0			0
	n	3	4	3	3	2	4			3
Summer										
Lingayen Gulf	% within limit	91	94	100	100	72	75	100	43	100
	% beyond limit	9	6	0	0	28	25	0	57	0
	n	33	53	53	52	53	53	51	7	13
Manila Bay	% within limit		100	100	98	10	100			
	% beyond limit		0	0	2	90	0			
	n		42	42	42	42	15			
Calauag Bay	% within limit		100	100	100	100				
	% beyond limit		0	0	0	0				
	n		17	18	18	18				
San Miguel Bay	% within limit		94	100	100	81			25	
	% beyond limit		6	0	0	19			75	
	n		16	16	16	16			4	
Ragay Gulf	% within limit	28			4	8		100		100
	% beyond limit	72			96	92		0		0
	n	25			25	25		7		25
Lagonoy Gulf	% within limit	100	100	100	53	93		90		97
	% beyond limit	0	0	0	47	7		10		3
	n	30	15	15	15	15		73		30
Carigara Bay	% within limit	100	100		100	80				57
	% beyond limit	0	0		0	20				43
	n	21	21		21	20				21
San Pedro Bay	% within limit		0	100	100	0				
	% beyond limit		100	0	0	100				
	n		2	2	2	2				
Sogod Bay	% within limit	97	84		85	84	100			97
	% beyond limit	3	16		15	16	0			3
	n	124	124		124	124	66			124
Panguil Bay	% within limit								100	
	% beyond limit	none	none	none	none	none	none	none	0	none
	n								12	
Pacific Seaboard	% within limit	97		100	100	94	100			
	% beyond limit	3		0	0	6	0			
	n	28		35	35	36	35			
South China Sea	% within limit	100	100	100	100	100	100			100
	% beyond limit	0	0	0	0	0	0			0
	n	14	11	4	11	11	14			14

respectively. Seven percent of TSS values in San Miguel Bay during the SW monsoon exceeded the criteria. High TSS values may be attributed to proximity to large river systems such as in San Miguel Bay and Lingayen Gulf.

The metals zinc, mercury and arsenic were in general below detection limit in the study sites, except for Manila Bay where mercury and zinc concentrations were above the permissible level. Reported levels of copper, cadmium and lead for San Miguel Bay, Sorsogon Bay and Lagonoy Gulf were slightly above the criteria of DENR. Chromium in Panguil Bay was also above the allowable limit. Pesticide residues were determined only in San Miguel Bay, Sorsogon Bay and Manila Bay, with all three reporting nondetectable values.

The bacteriological pollution surveys that were conducted during the SW monsoon in Sorsogon Bay and Lingayen Gulf showed 100% of the counts exceeding the allowable count of 200 MPN / 100 ml. A number of areas showed high fecal coliform counts in San Miguel Bay, Sorsogon Bay and Lingayen Gulf with maximum values reaching as much as 51,500; 780,000; and 16,000 MPN / 100 ml, respectively.

The pH readings in all the study sites in summer and NE monsoon were normally within the allowable pH range of 6-8.5. However, during the SW monsoon, 73% of the pH readings in Carigara Bay were beyond the maximum limit of 8.5 pH units.

To sum up, among the water quality parameters assessed, 80-100% “exceedance” beyond the allowable limit was seen for DO and nutrients, and much less (10-30%) for other parameters.

Historical Perspective

Case study: Manila Bay vis-à-vis influence of population

Manila Bay is a shallow estuary receiving drainage from immediate watersheds through tributaries and major river systems. The population covering the whole drainage area is estimated to be 16 million (NSO 1996). Large amounts of waste drain into the bay from domestic discharges since only 15% of the population is connected to the Metro Manila sewerage system (IMO 1994). The rest of the population discharges their waste to septic tanks or directly to rivers that end up in the bay.

Since the early 1980s, with rapid increase in population and industrialization within the Manila Bay region, water quality was expected to deteriorate. The scatter plot distribution of water quality indicators monitored at different areas within the bay, from mid-1990s to present, shows a very variable concentration range (Figure 2). The widest range was observed in years with the most intensive surveys. Typically, high nutrient concentrations were observed near rivers and towards sediments. Similar observations were reported by Acorda (1985). Based on the proposed ASEAN criteria for nutrients (McPherson *et al.* 1999), the average concentrations of ammonia, nitrite and nitrate from 1995 to present were all within the allowable level. However, phosphate levels from 1985 to present were close to or beyond the criteria value (Acorda 1985). No specific trends could be observed on the average concentrations of different water quality parameters, but the scatter plot distribution showed that average nitrite, nitrate, phosphate and chlorophyll-a values were relatively high in 2002 (Figure 2). Phosphates in Manila Bay are sourced from agricultural inputs discharged into it through Pampanga River and in the Bulacan area aside from the discharge from the population centers of phosphate-associated detergents. A number of chlorophyll-a values exceeded the criteria especially in 1995 during the peak of *Pyrodinium* bloom. The mean DO values in the bay were within the 5 mg / l limit. Surface concentrations were typically high but near bottom values from 1998 to 2002 were very low and approached anoxic condition. The bottom water quality based on oxygen availability has clearly shown rapid deterioration.

Using a hypothetical model to estimate the duration of oxygen depletion in the water column, the following assumptions were considered: (1) oxygen from air-sea interaction and replenishment due to water mixing is negligible and (2) the major source of O_2 in the water is photosynthesis. Using the population in the Manila Bay region, an effluent load factor of 20 kg person^{-1} year^{-1} biological oxygen demand (BOD) was assumed (Economopoulos 1993). The average DO concentrations at the surface, mid–depth and near bottom from 1995 to 1998 were used as ambient concentration for the estimate. The duration of oxygen depletion was estimated using the equation:

$$T = \frac{DO}{\left(\frac{L * Npop}{V}\right)}$$

where: T is the duration in hours; L is the BOD in kg person^{-1} year^{-1}; Npop is the population in the area; V is the volume of the bay (m^3); and DO is measured oxygen concentration in mg / m^3.

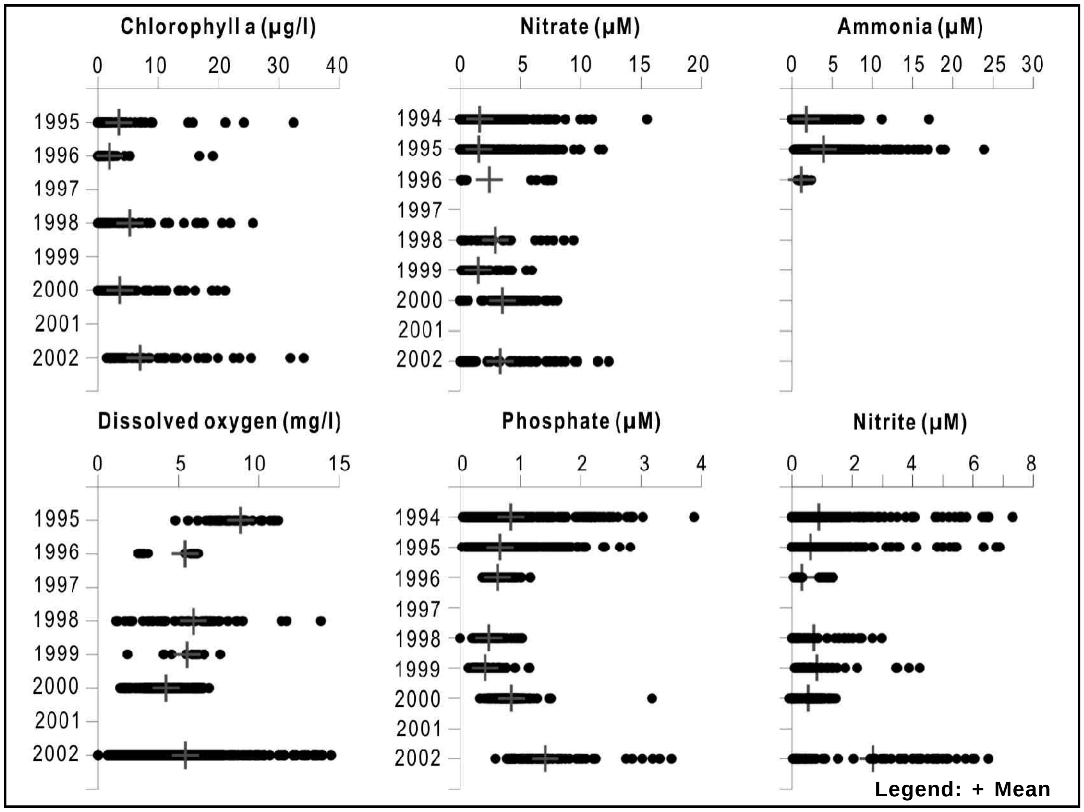


Figure 2. Time series profiles of different water quality parameters in Manila Bay.

The model estimates indicate rapid depletion of oxygen in the water as organic load in water continues to increase. In 1975, with an estimated 8 million population in the area, the oxygen was depleted to 0 mg/l after 300, 250 and 80 days when the ambient concentration was 8, 6 and 1.8 mg/l, respectively. With the present population and an oxygen concentration of <1.8 mg/l for water near the bottom, the water could become anoxic in less than 40 days (Figure 3). If this scenario happens in Manila Bay and with the continued increase in population, the condition will pose a serious impact on the fisheries resources of the area.

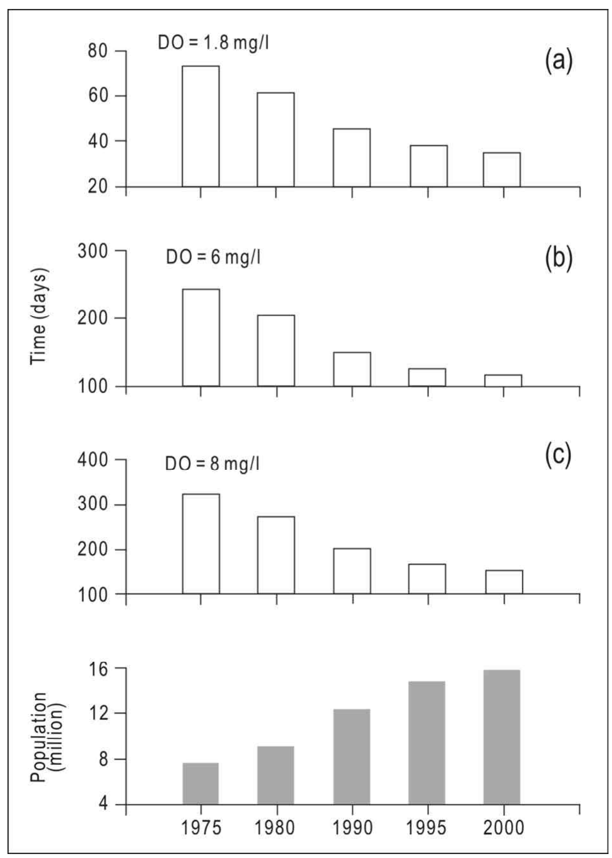


Figure 3. Oxygen depletion in the waters of Manila Bay based on assumed DO levels at the: (a) bottom, (b) mid-depth and (c) surface waters, and increasing population levels around Manila Bay.

Case study: Cape Bolinao vis-à-vis influence of mariculture activities

One of the emerging issues in the coastal waters of the country is increased finfish mariculture activity pursued at the expense of the environment. Lingayen Gulf, specifically in Bolinao, Pangasinan, illustrates this issue. In February 2002, a major fish kill occurred where thousands of kilos of milkfish in fish cages and pens died, and many reef fishes too, with losses estimated to be in the order of P500 million. Looking back, this event was expected. Mariculture started in 1995 with over 200 structures and expanded to more than 1,000 in 2001, more than double the number of units set by the Bolinao Municipal Fisheries Ordinance. This trend is reflected in changes in water quality over the years (Figure 4). Within a six-year period, there have been increases in: ammonia, 110%; nitrite, 30%; nitrate, 25%; phosphate, 400%; TSS, 222%; and chlorophyll-a, 140%. The fish kill coincided with a bloom of a dinoflagellate identified as *Prorocentrum minimum* (the first reported bloom occurrence in the Philippines), an organism associated with eutrophied (nutrient-rich) waters. Die-off of the bloom and large amounts of unconsumed fish feed material have contributed to high organic load, which when decomposed exhausted the oxygen in the water. Low DO (<2mg/l) can cause suffocation of gill-breathing aquatic organisms, and is one of the common causes of fish kill.

Fortunately, there have been positive developments, both local and national, to address the issue, in terms of response mechanism, regulation, research and management. In Bolinao, there has been a substantial reduction in the number of aquaculture structures. A National Forum on Fish Kill Events was held, an output of which is a contingency plan for a national strategy to monitor, manage and cope with fish kill events in aquaculture sites. An ongoing initiative, spearheaded by the Philippine Council for Aquatic and Marine Resources Research and Development, is the formulation of guidelines on the establishment of fish cages in lakes and coastal waters. The DENR is reviving discussions on the Environmental Impact Statement Programmatic Compliance Policy, while BFAR is reviewing the Code of Conduct for Aquaculture. The Bureau of Agricultural Research (BAR) is providing funds to conduct research on the development of environmental criteria and polyculture systems to mitigate waste and increase production, among others.

Fish pen and cage mariculture is emerging as the next frontier for fish production. Considering this trend of expansion, the fish kill in Bolinao can become but a common occurrence. Environmental issues will then have to be addressed to make this activity a sustainable one.

Key Issues and Management Directions

Contamination of the country's coastal and marine waters will continue and increase with the inevitable population and economic growth. The sources of contamination that eventually lead to marine pollution are well known and have been identified in the study sites, namely: domestic and industrial wastes, agrochemical loading, siltation/sedimentation, toxic and hazardous wastes (including heavy metals and mine tailings), and oil pollution (Table 4).

The assessments of marine water quality for the 12 FSP bays focused on relatively easy parameters to measure, and these efforts were not necessarily linked to sources and kinds of pollutants that affect(ed) the study site. What became apparent was that even with the most basic water quality parameters measured, no standard protocols for sampling and analyses were adopted. For instance, "surface" samples were obtained from "skin" of the water column, at some depth just below the surface, or were a composite of grab samples from the same site. Seawater samples were filtered or not. If filtration was done, various groups used a variety of filter sizes and materials. As a result, the quality of data generated among the groups that did assessments for the 12 bays were not necessarily comparable. Thus, it was difficult and sometimes impossible to compare water quality between and among bays, and to make valid statements about spatial and temporal characteristics and changes.

The determination of heavy metals in seawater in water quality monitoring programs might be downsized to focus instead on sediments and sentinel organisms such as bivalves. While there are continuing attempts to improve capabilities of laboratories to measure heavy metals in seawater, very few groups are able to demonstrate the ability to consistently produce reliable data at very low environmental concentrations. This became clear when the values on heavy metals in seawater for the various bays were assessed and were found to be, at best, suspect.

There are obvious limitations to only using water quality physico-chemical parameters so that other measures of ecosystem health, particularly of fishing grounds, will also have to be utilized (e.g., biological parameters) to complement water quality monitoring programs. A network of "reference laboratories" in the country should be established for the determination of specific contaminants. These can provide training for field and laboratory methods for marine pollution monitoring. If active linkages are developed among these laboratories and others striving to improve their capabilities, it is conceivable that the network will expand and fill the growing need to conduct relevant and reliable marine pollution monitoring programs in the country.

While a common pollution database has yet to emerge for the country, a more effective mechanism will have to be found to promote the sharing of information so that periodic assessments of the state of the marine environment can be facilitated.

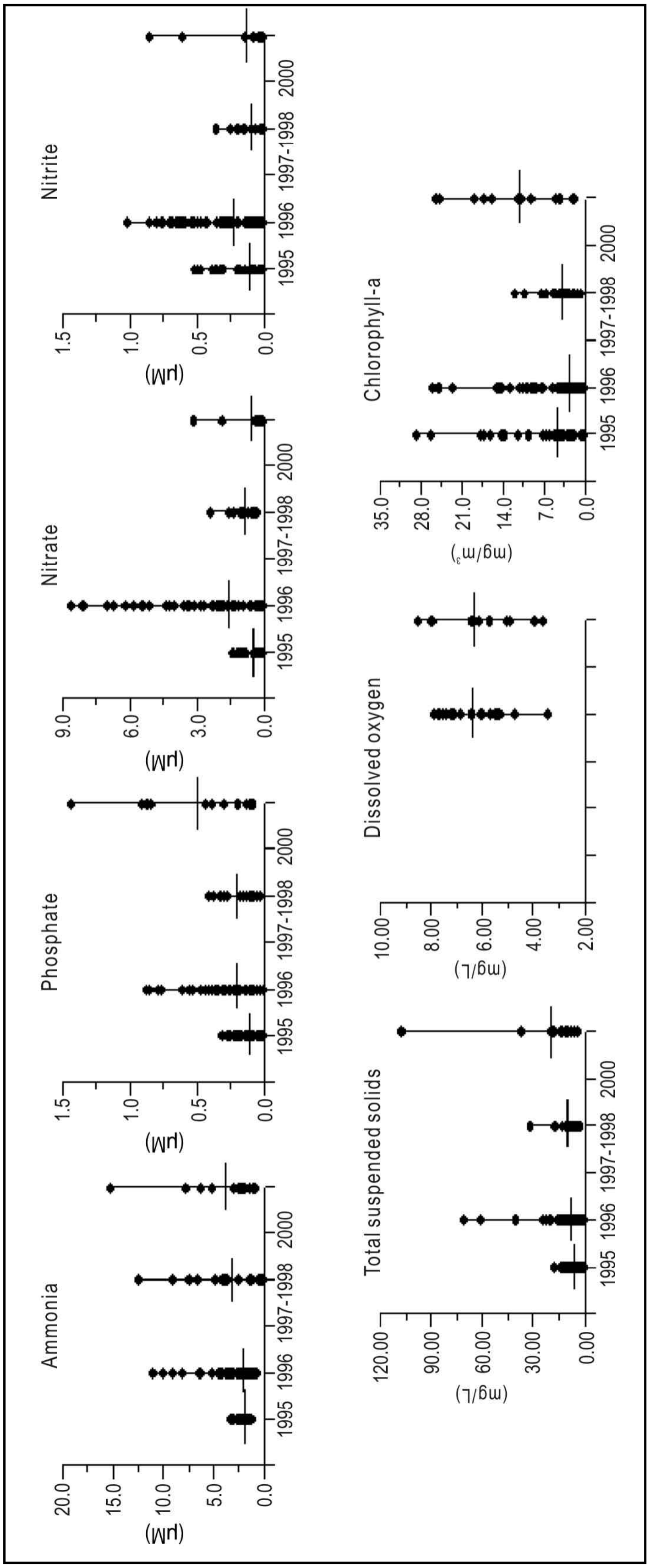


Figure 4. Historical trend in water quality for Bolinao (Sector I), 1995-2000 (EC-CERDS 1995-1996; LGCAMC 1997-1998; FRMP 2000).

Table 4. Water quality issues and interventions.

Study Site	Issues	Interventions
Manila Bay	Metal pollution (Cu, Zn, Pb and Hg, based on 10 rivers)	A comprehensive and implementable environmental management for Metro Manila
	Eutrophication due to industrial and agricultural wastes	A comprehensive and implementable environmental management for Metro Manila
	Occurrence of red tide	Research on the symbiotic relationships of dinoflagellates with the organisms they are affecting
		General suggestions: Implement environmental enhancement projects Develop upland and inland erosion prevention measures Enhance private sector cooperation Conduct environmental awareness program
Calauag Bay	Siltation	Mangrove rehabilitation/reforestation (Environment Management Bureau-DENR)
San Miguel Bay	Intensification of agri-aquaculture activities Mining (copper, iron and manganese) and other industries Quarrying Effluents from commercial operations Domestic sewage	Monitoring of upland and lowland resource users and conduct information/education campaign to create awareness of the problem
	Siltation High suspended solids on riverine stations Low DO levels and transparency values	Reforestation of denuded upland areas
Ragay Gulf	Increase in population and human activities, which will eventually create waste disposal problems	Proper waste management
	Siltation	Proper watershed management
Lagonoy Gulf	Increase in water temperature possibly due to thermal discharges from Tiwi Geothermal Plant	Coastal resource management (CRM) and establishment of environmental monitoring system
	Increase in TSS due to domestic discharges and erosion	Mangrove and watershed reforestation
Sorsogon Bay	Siltation in river/river mouths due to logging and *kaingin*	Mangrove reforestation; study on alternative source of fuel aside from mangroves; prevention of further logging activities in the area Reforestation in the uplands
	Lack of sanitation facilities such as sewerage systems and toilets	Sanitation program that will include education and proper siting and installation of sanitary facilities
	Unregulated use of chemicals (i.e., fertilizers and pesticides) in agricultural and aquaculture farms	Continuous monitoring of levels; education and information campaign regarding effects of unregulated or excessive pesticide and fertilizer uses
	Accumulation of nonbiodegradable waste in inland waters due to improper garbage disposal	Waste segregation and recycling; waste management at home and in industries (piggeries, bakeries, etc.) should be taught to constituents in regular barangay sessions
Carigara Bay	Siltation (from Naugisan and Carigara Bay)	Prohibit cutting of mangroves and start replanting them (DENR) Management and zoning of mangrove areas Shoreline land use should also be zoned (Department of Agriculture and DENR)
	Bacteriological pollution (localized fecal coliform contamination)	
	Bloom of dinoflagellates (*Pyrodinium bahamense*)	Early warning scheme to prevent paralytic shellfish poisoning
San Pedro Bay	Domestic sewage particularly near urban areas Intensive agriculture activities	Zonation of San Pedro Bay Development of alternative livelihood program Mitigation of human impacts to coastal zone
Sogod Bay		
Panguil Bay		CRM Establishment of sanitary landfills Monitoring of various water quality parameters

Models of viable and practical multisectoral pollution monitoring programs need to be developed and replicated. National government institutions are unable to effectively implement pollution monitoring programs because of various constraints, not the least of which is inadequate financial resources. To sustain such programs, activities could be done at specific sites (e.g., bay areas) linked with local government, private sector and possibly nongovernment organizations.

Finally, better packaging and utilization of pollution monitoring data will be imperative. Otherwise, the undertaking becomes an expensive, monitoring-for-monitoring's sake exercise with no real value to policymakers, and habitats, organisms and people who are to be protected.

References

Acorda, L. 1985. Manila Bay study. Quezon City, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1992a. Resource and ecological assessment studies: Manila Bay. Terminal Report. Mandala Agricultural Development Corporation and National Museum, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1992b. Resource and ecological assessment studies: Panguil Bay. Terminal Report. Mindanao State University at Naawan, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1992c. Resource and ecological assessment studies: San Pedro Bay. Terminal Report. University of the Philippines in the Visayas Foundation Inc., Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1992d. Resource and ecological assessment studies: Tayabas Bay. Terminal Report. Manuel S. Enverga University Foundation Inc., Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1993. Resource and ecological assessment studies: Calauag Bay. Terminal Report. Environmental Primemovers of Asia Inc., Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1994a. Resource and ecological assessment studies: Carigara Bay. Terminal Report. Silliman University, Negros Oriental, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1994b. Resource and ecological assessment studies: Sogod Bay. Terminal Report. Silliman University, Negros Oriental, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1995a. Resource and ecological assessment studies: Lagonoy Gulf. Terminal Report. ICLARM and Bicol University, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1995b. Resource and ecological assessment studies: Ormoc Bay. Terminal Report. University of the Philippines in the Visayas Foundation Inc., Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1995c. Resource and ecological assessment studies: San Miguel Bay. Terminal Report. ICLARM and Bicol University, Philpppines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1995d. Resource and ecological assessment studies: Sorsogon Bay. Terminal Report. UB Tech Inc., Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1996. Resource and ecological assessment studies: Ragay Gulf. Terminal Report. University of the Philippines at Los Baños Foundation, Philippines.

DENR (Department of Environment and Natural Resources). 1995. Administrative Order No. 34, Series of 1990. Philippine environmental impact statement programmatic compliance guidebook. DENR, Philippines.

EC-CERDS (European Commission-Coastal Ecosystem Responses to Deforestation - Derived Siltation in Southeast Asia). 1995-1998. Effects of deforestation-derived siltation on nutrient cycling and loading. Terminal Report 1998.

Economopoulos, A.P. 1993. Assessment of sources of air, water and land pollution: A guide to rapid source inventory techniques and their use in formulating environmental control strategies. World Health Organization, Geneva, Switzerland.

FRMP (Fisheries Resource Management Project). 2002. Resource and social assessment of Lingayen Gulf. Draft Terminal Report. Fisheries Resource Management Project, Manila, Philippines.

IMO (International Maritime Organization). 1994. Global survey case study on the development of waste management options to phase-out ocean dumping of industrial wastes in the Philippines. IMO Tech. Rep.

LGCAMC (Lingayen Gulf Coastal Area Management Commission). 1997-1998. Development of criteria for coastal zoning in Lingayen Gulf: A case study for the aquaculture and fishpen industries. LGCAMC, Philippines.

McPherson, C.A., P.M. Chapman, G.A. Vigers and K.S. Ong. 1999. ASEAN marine water quality criteria: Contextual framework, principles, methodology and criteria for 18 parameters. ASEAN Marine Environmental Quality Criteria–Working Group (AMEQC-WG), ASEAN-Canada Cooperative Programme on Marine Science - Phase II (CPMS-II). EVS Environment Consultants, North Vancouver, Canada, and Department of Fisheries, Malaysia. 568 p.

NSO (National Statistics Office). 1996. 1995 census of population. National Statistics Office, Manila, Philippines.

PEMSEA (GEF/UNDP/IMO Regional Programme on Partnerships in Environmental Management for the Seas of East Asia). 2001. Manila Bay initial risk assessment. PEMSEA, Quezon City, Philippines.

Marine Protected Species in the Philippines[1]

MOONYEEN NIDA R. ALAVA[2]
JOSE ALFRED B. CANTOS
World Wide Fund for Nature - Philippines
LBI Bldg., 57 Kalayaan Ave., Diliman, Quezon City
Philippines

"wild flora and fauna constitute a natural heritage of aesthetic, scientific, cultural, recreational, economic and intrinsic value that needs to be preserved and handed on to future generations"- Preamble to the Bern Convention

Introduction

The Philippines is located in the most biologically diverse marine area in the world in terms of coral and tropical reef fish diversity (Briggs 1999). It is globally important for its marine ecosystems that support populations of highly varied marine organisms, and which contribute much to the country's economy (BFAR 2001). However, unsustainable uses of these resources have led to declining populations of marine species causing the removal of some species from specified geographic areas and overall ecosystem degradation. The Philippines has enacted protective legislation and regulations for a few marine species as concern over threats to these species increased. Such species with local and national protection are referred herein as legally protected marine species in Philippine waters.

This paper focuses on "species of concern", such as sea turtles, dugong, cetaceans, whale sharks and mantas, all large marine vertebrates. Information on the conservation status of species is provided by the World Conservation Union (IUCN)[3] through its Species Survival Commission that regularly publishes "Red Lists" of species with varying levels of threat. The conservation status of each of the species of concern based on the IUCN Red List (Hilton-Taylor 2000) is shown in Table 1. The Philippines through the Protected Areas and Wildlife Bureau (PAWB) of the Department of Environment and Natural Resources (DENR) is a national agency member since 1968 together with several nongovernment organization (NGO) members.

Species of Concern

Sea turtles. This group of reptiles together with sea snakes have successfully thrived in the marine environment. Five species have been recorded in the Philippines, namely: Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Olive ridley turtle (*Lepidochelys olivacea*), Loggerhead turtle (*Caretta caretta*) and Leatherback turtle (*Dermochelys coriacea*) (De Veyra and Ramirez 1994; Cruz 1999; PCP 1999). The most abundant species are the Green turtle, occurring throughout Philippine waters (with important nesting concentrations in the Turtle Islands and Bancauan Island, Tawi-Tawi) and the Hawksbill turtle, occurring widely with low nesting densities on numerous islands.

Dugong. The Dugong (*Dugong dugon*) is the only survivor of the family Dugongidae and the only representative of the order Sirenia. Dugong is the only herbivorous marine mammal that maintains a relatively small home range as compared to the migratory green turtle. Its population is believed to be fragmented and its numbers low and declining (Marsh *et al.* 2002). Historical records indicate that Dugong were common,

[1] This paper can be cited as follows: ALAVA, M.N.R. AND J.A.B. CANTOS. 2004. Marine protected species in the Philippines, p. 109-117. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.
[2] Current address is: WorldFish Center - Philippine Office, Khush Hall, IRRI, Los Baños, Laguna, Philippines.
[3] Founded in 1948, IUCN is an alliance of states, government agencies and NGOs. It has 980 members, spread across some 140 countries, which seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

Table 1. List of marine protected vertebrate species in the Philippines with protection and conservation status based on CITES Appendix listing and IUCN Red List criteria and categories. (Legend: A = CITES Appendix Listing I or II; CR = critically endangered; DD = data-deficient; EN = endangered; LR/cd = lower risk, conservation dependent; VU = vulnerable.)

Taxa	Common Name	CITES	Red List 2000
Class Reptilia			
Order Testudina			
Family Chelonia (sea turtles)			
Chelonia mydas (Linnaeus, 1758)	Green turtle	A-I	EN A1bd
Caretta caretta (Linnaeus, 1758)	Loggerhead turtle	A-I	EN A1abd
Eretmochelys imbricata (Linnaeus, 1766)	Hawksbill turtle	A-I	CR A1bd
Lepidochelys olivacea (Eschscholtz, 1829)	Olive ridley turtle	A-I	EN A1bd
Family Dermochelyidae			
Dermochelys coriacea (Vandelli, 1761)	Leatherback turtle	A-I	CR A1abd
Class Mammalia			
Order Sirenia			
Family Dugongidae (sea cow)			
Dugong dugon (P.L.S. Müller, 1776)	Dugong	A-I (except Australian population)	VU A1cd (IUCN 2002)
Order Cetacea			
Family Balaenopteridae			
Balaenoptera physalus (Linnaeus, 1758)	Fin whale	A-I	EN – A1abd
Balaenoptera edeni Anderson, 1878	Bryde's whale	A-I	DD
Megaptera novaeangliae(Borowski, 1781)	Humpback whale	A-I	VU A1ad
Family Delphinidae			
Feresa attenuata Gray, 1875	Pygmy killer whale	A-II	DD
Globicephala macrorhynchus Gray, 1846	Short-finned pilot whale	A-II	LR/cd
Grampus griseus (G. Cuvier, 1812)	Risso's dolphin	A-II	DD
Lagenodelphis hosei Fraser, 1956	Fraser's dolphin	A-II	DD
Orcaella brevirostris (Gray, 1866)	Irrawaddy dolphin	A-II	DD
Orcinus orca (Linnaeus, 1758)	Killer whale	A-II	LR/cd
Sousa chinensis (Osbeck, 1765)	Indo-Pacific humpback dolphin	A-I	DD
Peponocephala electra (Gray, 1846)	Melon-headed whale	A-II	LR/lc
Pseudorca crassidens (Owen, 1846)	False killer whale	A-II	LR/lc
Stenella attenuata (Gray, 1846)	Pantropical spotted dolphin	A-II	LR/cd
Stenella longirostris (Gray, 1828)	Spinner dolphin	A-II	LR/cd
Steno bredanensis (Lesson, 1828)	Rough-toothed dolphin	A-II	DD
*Stenella coeruleoalba (*Meyen, 1833)	Striped dolphin	A-II	LR/cd
Tursiops truncatus (Montagu, 1821)	Bottlenose dolphin	A-II	DD
Family Kogiidae			
Kogia simus	Dwarf sperm whale	A-II	LR/lc
Family Physeteridae			
Physeter catodon Linnaeus, 1766	Sperm whale	A-I	VU A1bd
Family Ziphiidae			
Mesoplodon densirostris (de Blainville, 1817)	Blainville's beaked whale	A-II	DD
Ziphius cavirostris G. Cuvier, 1823	Cuvier's beaked whale	A-II	DD
Class Elasmobranchii			
Order Orectolobiformes			
Family Rhincodontidae			
Rhincodon typus Smith, 1828	Whale shark	A-II	VU A1bd+2d
Order Rajiformes			
Family Mobulidae			
Manta birostris (Walbaum, 1792)	Manta ray	-	DD
Class Actinopterygii			
Order Syngnathiformes			
Family Syngnathidae			
Hippocampus barbouri Jordan and Richardson, 1908	Barbour's seahorse	A- II for all *Hippocampus* spp. (Enters into effect on 15 May 2004)	VU A4cd
Hippocampus bargibanti Whitley, 1970	Pygmy seahorse		DD
Hippocampus comes Cantor, 1850	Tiger tail seahorse		VU A2cd
Hippocampus kelloggi Jordan and Snyder, 1902	Great seahorse		DD
Hippocampus kuda Bleeker, 1852	Common seahorse		VU A2cd
Hippocampus spinosissimus Weber, 1913	Hedgehog seahorse		VU A2cd
Hippocampus trimaculatus Leach, 1814	Flat-faced seahorse		VU A1cd+2cd

although not abundant, around the Philippines, particularly in the Eastern Philippine coasts (De Elera, 1915; PCP 1999). In these places, their distribution is now greatly reduced. Small numbers occur in Palawan, Sulu Archipelago, southern Mindanao, Guimaras Strait and Panay Gulf, northeastern Luzon, and northeastern Mindanao (Torres 2002; Perrin *et al.* 2002).

Dolphins and whales. These belong to the order Cetacea which is divided into two suborders, the baleen whales (Mysticeti) and toothed whales (Odontoceti). These are represented in the Philippines by at least 21 species belonging to 5 families (Heaney *et al.*1998; Bautista 2002; Perrin *et al.* 2002;). The more common and abundant species based on sightings and line transect surveys are: Spinner dolphin (*Stenella longirostris*), Pantropical spotted dolphin (*Stenella attenuata*), Bottlenose dolphins (*Tursiops truncatus*), Fraser's dolphin (*Lagenodelphis hosei*) and Short-finned pilot whales (*Globicephala macrorhynchus*) (Dolar and Wood 1992; Alava *et al.* 1993; Leatherwood *et al.* 1993; Dolar and Perrin 1996; Dolar 1999). Large cetaceans, such as the Sperm whales (*Physeter catodon*) and the baleen whales (Fin whale, *Balaenoptera physalus* and Bryde's whale, *B. edeni*) are few and rare. Historical records show Humpback whales (*Megaptera novaeangliae*) were sighted off southwestern Palawan and in southern Sulu Sea (Slipjer *et al.* 1964), but current records show the species to be sighted only off Babuyan Island, northern Luzon (Yaptinchay 1999; Acebes 2001). The Irrawaddy dolphins (*Orcaella brevirostris*) have a restricted distribution and are found only in the southern part of the Malampaya Sound, northwestern Palawan (Del Valle and Aquino 2002; Dolar *et al.*2002; Smith *et al.* 2002).

Whale sharks and mantas. These are 2 out of over 160 species of cartilaginous fishes (class Chondrichthyes) confirmed present in Philippine waters (Compagno *et al.*, in prep.). The Whale shark (*Rhincodon typus*) is the only representative of the family Rhincodontidae while the manta (*Manta birostris*) is the only representative of its genera under the family Mobulidae (devilrays) both of which are under the order Elasmobranchii. Two of the largest living fishes in the world, both species feed on small planktonic organisms in sea waters. Being highly migratory, they are observed in many areas of the Philippines, occurring singly or in groups, nearshore and offshore. Fishery records show they are abundant particularly around the Bohol and Sulu Seas and southeastern Mindanao (Alava *et al.* 1997a, 1997b). Recently, seasonal aggregations of Whale shark has been found to occur in Donsol, Sorsogon (Alava and Yaptinchay 2000), Honda Bay, Palawan (Torres *et al.* 2000) and Zambales coasts.

Seahorses. Along with pipefishes, pipehorses and seadragons, all seahorses (*Hippocampus* species) are members of the family Syngnathidae. Of the 32 known species of seahorses in the world, 8 have been found to occur in the Philippines. They are found generally in shallow waters including seagrasses, mangrove roots, corals, open sand, muddy bottom estuaries and lagoons. They are bony fishes with curved trunk, head that resembles a horse and a fully prehensile tail. Historical records indicate that seahorse distribution is abundant particularly in Bohol, Cebu, Zamboanga and Palawan.

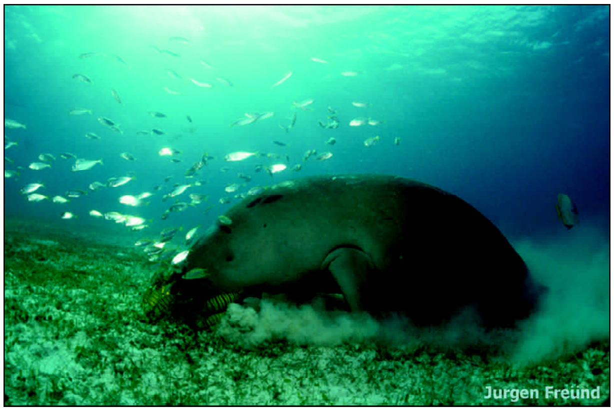
History of Utilization

Most of these species have a long history of traditional, cultural and commercial utilization in various parts of the world. In the Philippines, the exploitation of these species is also not of recent origin. Exploitation of some turtle species predates the Spanish period (1521-1899) and has continued to the present (Eckert 1993). Dugong have been utilized as food as early as 9th century AD (Bautista 1990), and also in ritual offerings in the Early Metal Age from 500 to 200 BC (Fox 1970) and came into commercial importance in the Spanish period (De Elera 1915; Seale 1915).

The very early reports of cetacean harvests were on Sperm whales (*Physeter macrocephalus*) between 1761 and 1935 by American whalerships (Townsend 1935). Traditional hunters from Pamilacan and Camiguin Islands used harpoons and gaff hooks around Bohol Sea since World War II (Dolar *et al.* 1994). The same hunting implements were used in Whale shark and manta fishery at about the same time (Alava *et al.* 1997a). Initially, the techniques were localized in these traditional fishing villages and then slowly expanded to neighboring ones (e.g., Talisayan, Misamis Oriental), and escalated full force by mid-1990s with new whale shark fishery sites sprouting all over to meet increasing local and international demand for its meat (Alava *et al.* 1997b).

Most species are slaughtered primarily for their high quality but inexpensive meat (Dugong, cetaceans, whale sharks, manta), while others are exploited for their body parts (*e.g.*, eggs, leather, oil, shell, skin, fat, bones, blubber, gastrointestinal tract, sex organs, fins, teeth) which have many uses to humans, as food, bait to catch sharks and chambered nautilus, *Nautilus pompilius* (Dolar *et al.* 1994; Dolar *et al.* 1997),

Marine Protected Species Found in the Philippines



Dugong (*Dugong dugon*)

M. Alava

Spinner dolphin (*Stenella longirostris*)

Whale shark (*Rhincodon typus*)

Hawksbill turtle (*Eretmochelys imbricata*)

aphrodisiacs or various medicinal properties, both for local and / or international markets (Eckert and Eckert 1989; PCP 1999). With the lifting of trade barriers and increased prices brought about by fast growth in the East Asian market, import of these animals and their by-products has increased in the past 30 years (Milliken and Tokunaga 1987; Alava and Yaptinchay 2000).

Threats and Biological Constraints

Threats are basically posed on the species itself (direct impact) by natural (e.g., death by predation or diseases) and anthropogenic sources. Being large marine vertebrates, sea turtles, Dugong and cetaceans (marine mammals), Whale shark and mantas (elasmobranches) generally have very few natural predators and have adapted accordingly to be long-living, with slow growth, late sexual maturity, low fecundity and lower rates of recovery due to their lower reproduction potential. The impact of humans is very influential to their survival. Primary threats from humans are through overexploitation and unsustainable harvests or on their habitats through degradation or loss (Sala *et al.* 2000). Critical habitats include nesting sites (e.g., beach slopes for sea turtles), feeding or grazing areas (e.g., seagrass ecosystems for turtles and dugongs; coral reefs and coastal areas for some species of dolphins; mangroves, estuaries and embayments as source of food for filter-feeding species, such as Whale shark and manta), and mating or breeding areas (e.g., offshore island waters for Humpbacks and other cetaceans).

Since most of the critical habitats overlap with areas of increasing fishing operations, species are also highly susceptible to by-catch in both commercial and artisanal fisheries. By-catch has a drastic impact on the species, often leading to irrevocable loss (Perrin 2002). Drift net fisheries could be the top killer of many marine wildlife species, particularly small cetaceans and sea turtles. Often referred to as the "walls of death", driftnets usually have a length of as long as 60 km and indiscriminately snare not only target species (such as salmon, tuna, squid, etc.) but also a variety of marine mammals, such as young whales, dolphins, porpoises, fur seals and sea animals such as sea turtle, sea birds, sharks and other fish species (Paul 1994; Takashi 1997). Modified drift gill nets are operational within Philippine waters. Other gears that also by-catch dolphins are baby ringnet, bagnet, beach seine, set gillnet, bottom longline, castnet, crab trap, drift longline, drivenet, fish corral, flying fish net, stationary liftnet, two-boat lift net, purse seine, shark net and troll line (Alava and Dolar 1995; Dolar 1999; Perrin et al. 2002). Dugongs are by-caught in fish corrals (PCP 1999; Alava 2002).

Regulations and Management

Species protection

Initial regulations and management policies have largely been concerned with commercial (i.e., abundance and size available for harvesting) rather than ecological value of species. Sea turtle capture is regulated by over 20 laws promulgated dating back to 1932 (Cola 1998). The laws were generally oriented to fisheries management, such as requiring licenses for marine turtle and egg collection and submission to customs for exportation, seasonal closure of the fishery, creation of a Task Force Pawikan (the government arm to manage marine turtles in Turtle Islands including regulation of their exploitation), and output control in terms of quota, size, species and reproductive state. The Philippine Fisheries Commission (presently the Bureau of Fisheries and Aquatic Resources [BFAR] of the Department of Agriculture [DA]) lost control of marine turtles in 1972 to the Parks and Wildlife Bureau (presently the Protected Area and Wildlife Bureau [PAWB]) of DENR by virtue of Administrative Order (AO) 68. Legislation associated with this change includes selective and total ban of the fishery, establishment of marine turtle sanctuaries, law enforcement and capacity-building of local executives (Cola 1998).

The regulation and management of marine mammals began with the creation of an interagency task force under DENR Special Order (SO) 590 for Dugong in 1991, and DENR SO 1636 for marine mammals. Dugong was declared by DENR as a protected marine mammal under AO 55 in 1991. The following year, reports of exploitation of dolphins led to the issuance of DA's Fisheries Administrative Order (FAO) 185 in 1992, known as the Dolphin Ban. This ban, however, was limited to members of the family Delphinidae only. This was later amended in 1998 under FAO 185-1 to include all other families under class Cetacea. Prior to its amendment, DENR created the Inter-agency Task Force on Marine Mammal Conservation (IATFMMC) through SO 1636 to undertake survey and assessment of marine mammal resources in the Philippines. IATFMMC, composed of DENR, BFAR, Department of Tourism, University of the Philippines-Marine Science Institute, Silliman University Marine Laboratory, World Wildlife Fund-Philippines and Bookmark, Inc., became the recommendatory body which identified marine mammal research, conservation and management needs and programs in the country.

In 1998, Republic Act (RA) 8550 (Philippine Fisheries Code) was enacted to update fishery management and development in the country. The mandate of DA-BFAR on cetacean conservation and management was explicitly defined with the issuance of FAO 208, listing rare, threatened and endangered fishery species. This list, however, inadvertently excluded the Irrawaddy dolphin, the most critically endangered species among all the cetaceans in the Philippines.

The need for Whale shark and manta ray conservation was initially identified by IATFMMC during its First National Marine Mammal Workshop conducted in 1995. The species, however, were only afforded protection in March 1998 through FAO 193, the first protection given for any shark species in the Philippines.

As a corollary to the Fisheries Code of 1998, the Wildlife Conservation Policy was updated through the Wildlife Act of 2001. Consistent with the Fisheries Code, the Wildlife Act specifically stipulates that marine mammal species except Dugong shall be under the jurisdiction of DA-BFAR. The management of Dugong and sea turtles remained with DENR-PAWB. Another feature of this policy is the acknowledgement of the Strategic Environmental Plan for Palawan, whereby responsibility for wildlife resources in Palawan, whether aquatic or terrestrial, was devolved to the Palawan Council for Sustainable Development (Palma 2002).

All of the species of concern are nonendemic and migratory, thus protection may entail more than local legislation and management. International protection, particularly from trade, is provided by the Convention on International Trade in Endangered Species of Wild

[4] The 1973 CITES is an international agreement among governments which aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES is legally binding among the parties (i.e., states that have agreed to be bound by the convention) and provides a framework to be respected by each party, which has to adopt its own domestic legislation to make sure that CITES is implemented at the national level. The Philippines has ratified the convention in 1981 and has co-proposed for the Appendix II listing of whale shark in the 12th Conference of Parties in Santiago, Chile, in November 2002.

Fauna and Flora (CITES)[4]. CITES (2002) provides three levels of protection through their appendice listings: Appendix I lists species threatened with extinction and generally prohibits species from commercial trade. Appendix II regulates international trade in species that may be threatened with extinction without trade controls. Appendix III lists species that are protected in at least one country that has asked for assistance in controlling the trade. Except for manta rays, all species above are listed under Appendix I or II of CITES and thus are also afforded full protection under the Fisheries Code.

For by-catch, there has been no national law that regulates and manages its impact. At the international level, a global moratorium on large-scale high-seas driftnet fishing (UN Resolution 46/215) was put into effect by the United Nations General Assembly on 31 December 1992 (Paul 1994; Takashi 1997), to which many countries purportedly complied with.

Habitat protection

Sea turtles are the first species to have their habitats protected. In 1982, the government established seven marine turtle sanctuaries in three provinces: Antique, Palawan and Tawi-tawi (AO No. 8). As sanctuaries, these areas cannot be alienated, disposed of and exploited. Extractive activities within 250 m from the shore at lowest tidal line of the sanctuaries are also prohibited. This move introduced habitat protection as a government strategy after relying heavily on regulation of species exploitation (Cola 1998).

In June 1992, the Philippine Congress passed RA 7586 providing for the establishment and management of a National Integrated Protected Areas System (NIPAS) to: “encompass outstandingly remarkable areas and biologically important public lands that are habitats of rare and endangered species of plants and animals, biogeographic zones and related ecosystems, whether terrestrial, wetland or marine, all of which shall be designated as ‘protected areas’”. The DENR later issued NIPAS Implementing Rules and Regulation (AO No. 25) which sets the steps for the establishment of NIPAS areas.

By virtue of the NIPAS law, a number of protected areas were established. Worth mentioning are some of the critical sites for species of concern, namely: the Turtle Islands Heritage Protected Area, breeding or resting areas for endangered turtles such as the hawksbill and green sea turtles (PCP 1999); Batanes Islands Protected Landscapes and Seascapes, possibly the southernmost breeding area of humpback whales in the western North Pacific and records 11 cetacean species including the humpback and sperm whales, and thus the most cetacean-diverse area surveyed to date (Yaptinchay 1999; Acebes *et al.* 2000; Acebes 2001); and the Malampaya Sound, the only known habitat of the Irrawaddy dolphin. Historically, Malampaya Sound is one of the most productive fishing grounds in the Philippines and hosts Green sea turtles and Sea cows. The declaration of protected areas accorded some form of protection for marine wildlife through its respective Protected Areas Management Board (PAMB).

Tañon Strait is declared a Protected Seascape under Presidential Proclamation No. 1234. A critical habitat for at least nine species of dolphins and whales, it was proposed as a marine mammal sanctuary prior to its proclamation as a protected seascape (Alava *et al.* 1993).

With the devolution of governance to LGUs under the Local Government Code of 1991, management of municipal waters within 15 km from the shore was turned over to them. Such autonomy encourages municipalities to implement conservation-linked development activities such as ecotourism (e.g., Bais City for dolphin and whale watching, Donsol for Whale shark interaction tours) (Palma 2002). The coastal waters of Donsol, Sorsogon, have been a Whale shark sanctuary by a municipal ordinance in March 1998. Green Island and Taytay Bays in Palawan have been proposed to be established as Dugong sanctuaries (PCP 1999) but are still awaiting endorsements from their respective LGUs.

Transfrontier management areas

In May 1996, a Memorandum of Agreement was signed by the governments of the Philippines and Malaysia establishing the Turtle Islands Heritage Protected Area as the world’s first ever transfrontier management area for sea turtles. This was recognized by conservationists as a landmark agreement as well as a novel and pragmatic approach to conserving sea turtle populations straddling the borders of two or more sites (Trono 2000).

Conservation Status and Challenges

Based on the IUCN Red List, only sea turtle species are either endangered or critically endangered while the Whale shark and three marine mammals are declared vulnerable. The rest of the species listed here are either data-deficient or at low risk globally (Hilton-Taylor 2000) (refer to Table 1). A recent review on the Irrawaddy dolphin population in Malampaya Sound using the IUCN Red List Categories and Criteria revealed that the species is critically endangered and is currently being recommended for inclusion in FAO 208 and the Philippine Red List (WWF-Philippines 2003).

Scanning through environmental policies ratified in years past, it is apparent that the Philippines has enough laws to ensure the survival of the species in question. Yet, despite decades of protection of these species, legal and illegal takes (e.g., continuous harvest of turtle eggs), poaching and covert trade (e.g., cetaceans, manta, Whale shark) and by-catch (e.g., cetaceans, Dugong) still persist. The laws are rarely enforced or evaluated. The need for protection of these species is ever present. The conservation challenge is whether protection of the species resulted in actual conservation of their biological and ecological viability. If considered from the fishery perspective, has protection ensured sustainability and productivity of stocks?

Conclusions and Recommendations

The Philippines is one of the world's megadiversity countries, with more than 52,177 described species (Ong *et al.* 2002), of which more than half are found nowhere else in the world. The magnitude of the critical threats to its outstanding biodiversity requires immediate attention if their effects on marine ecosystems are expected to be slowed and/or neutralized. The unsustainable pattern of resource use is aggravated by natural threats, which greatly contribute to biodiversity loss. The threats include competition with other species, diseases and predation exacerbated by swelling global human population that exerts additional pressures through unregulated collection, pollution and habitat degradation or loss.

Protection of the species is one of the most immediate and logical responses to its danger of becoming extinct. However, species of concern focus on more charismatic ones that are receiving the benefits of protection. Many other species, including sharks, skates and rays, are in great, or greater, need of conservation action and legal protection. The limit reference points, where there is serious stock collapse, are often unknown for a number of these species, particularly in the Philippines. Yet the precautionary reference points, such as increased fishing effort and decreased yields, have warned us that action is needed. Unless addressed, the socioeconomic repercussion of collapses to dependent communities will be large losses of employment and revenues. The government must be called upon to protect these species under the "precautionary approach" to management of these resources under Agenda 21.[5]

Habitat protection is also critical to conserve the species. The establishment and management of protected areas should, as far as possible, be designed to include areas important for all species of concern found in Philippine waters. Marine protected areas maintain the ecosystems' biodiversity by allowing species to evolve and function undisturbed while providing a safety margin against human-induced and natural disasters and offer a solid ecological base from which threatened species can recover. MPAs are conduit to the protection of marine corridors strategically situated in Philippine waters. They maintain ecosystem and evolutionary processes and guarantee the existence of species unique to our waters through the completion of their life stages. Protection of critical nesting sites has been done for sea turtles. Other areas need to be studied and highlighted for their ecological importance to the species, as breeding sites (e.g., Batanes Islands for Humpbacks) and critical habitats (e.g., Malampaya Sound for Irrawaddy dolphins; Green Island and Taytay Bays for Dugong).

More transfrontier management agreements among neighboring countries of the Philippines are needed to promote conservation and management initiatives of straddling stocks. A regional agreement is currently being drafted for the Whale sharks, in the wake of its CITES success.

However, while declarations of protected status of both species and their habitats are reassuring to conservationists, governments and environmental NGOs alike, without implementation of enforceable regulations, including appropriate institutional mechanisms and budgets to strengthen and sustain implementation of local and national laws relevant to species and habitat protection, these result in little effective protection. It is thus recommended that appropriate institutional mechanisms should be established to strengthen implementation of local and national laws relevant to species protection, including higher budgets to sustain enforcement, capacity-building and the conduct of research and monitoring necessary to increase the knowledge base on the resource being protected, without which the conservation challenge cannot be answered.

---

[5] The Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21 states: "In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation". The approach includes taking action in the face of uncertainty, shifting burdens of proof to those who create risks, analysis of alternatives to potentially harmful activities and participatory decisionmaking methods.

The uncertainties associated with decentralization of the government have also exacerbated environmental degradation. The shift of responsibilities to local agencies, with little experience and capacity to handle authority, creates a window of great pressure to successfully enforce national environmental laws and policies. The changing political leadership in the country also represents a constant shift of priorities and orientation on the implementation of resource use policies, laws and plans that should incorporate biodiversity conservation objectives. The absence of integrated policies among development sectors (e.g., DA, DENR and the Department of the Interior and Local Government) and an unclear coordination mechanism among national, provincial and local governments often create contradictory and sometimes overlapping policies.

Efforts must be exerted for a more integrated approach to conservation and management involving not only relevant government agencies and LGUs but also other stakeholders including NGOs, academe, people's organizations and most especially the local community that would advocate and influence the conservation and development planning processes. Concurrently, appropriate local and national information awareness programs on conservation of species and protection of their habitats must also be developed and implemented.

References

Acebes, J.V. 2001. Photographic identification of humpback whales (*Megaptera novaeanglia*) in the Babuyan islands, Northern Luzon, Philippines. Abstract. *In* Proceedings of the Fourteenth Biennial Conference on the Biology of Marine Mammals, 28 November-3 December 2001, Vancouver, Canada.

Acebes, J.V., C.A. Coronado, J.H. Sumangil, A.S. Silayan, E.Z. Dolumbal, G.M. Sano, R.C. Baltazar and J.G. Davies. 2000. Humpback whale (*Megaptera novaeangliae*) survey in the Babuyan Islands, Cagayan province, Philippines. A report submitted to the Cetacean Research and Conservation Project, Phase Two, World Wildlife Fund-Philippines. (Unpublished).

Alava, M.N.R. 2002. WWF cetacean-fisheries interaction and conservation management in the Philippines. Work. Doc. for the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of South-east Asia, 24-26 July 2002. Silliman University, Dumaguete City, Philippines. CMS/SEAMAMII/Doc. 29. (Unpublished).

Alava, M.N.R. and A.A. Yaptinchay. 2000. Whale sharks in the Philippines. Shark Conference 2000, 21-24 February 2000, Hawaii, USA..

Alava, M.N.R. and M.L.L. Dolar. 1995. Resource utilization on marine mammals in Visayas and Mindanao, Philippines. Abstracts. *In* Proceedings of the Eleventh Biennial Conference on the Biology of Marine Mammals, 14-18 December 1995, Florida, USA.

Alava, M.N.R., A.A. Yaptinchay, R.B. Trono and E.R.Z. Dolumbal. 1997a. Fishery and trade of whale sharks and manta rays in the Bohol Sea, Philippines. *In* Proceedings of the International Seminar and Workshop on Sharks and Ray Biodiversity, Conservation and Management, 7-10 July 1997, Sabah, Malaysia. Department of Fisheries-Sabah, IUCN Species Survival Commission's Shark Specialist Group.

Alava, M.N.R., A.A.Yaptinchay, G. Acogido, M.L.L. Dolar, C.J. Wood and S. Leatherwood. 1997b. Fishery and trade of whale shark (*Rhincodon typus*) in the Philippines. Abstract. *In* Proceedings of the Thirteenth American Elasmobranch Society Annual Meeting, Washington, USA.

Alava, M.N.R., M.L.L. Dolar, S. Leatherwood and C.J. Wood. 1993. Marine mammals of the Philippines. Asia Life Sci. 2: 227-234.

Bautista, A.P. 1990. A zooarchaeological perspective on the Ambangan site, a prehistoric settlement in Butuan, Agusan del Norte, southern Philippines. Indo-Pac. Prehist. Assoc. Bull. 1(10): 161-170.

Bautista, A.L. 2002. Cetaceans in the Philippines: An update for 2002. Work. Doc. for the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of South-east Asia, 24-26 July 2002. Silliman University, Dumaguete City, Philippines. CMS/SEAMAMII/Doc. 25. (Unpublished).

BFAR (Bureau of Fisheries and Aquatic Resources). 2001. Philippine fisheries profile. BFAR, Quezon City, Philippines.

Briggs, J.C. 1999. Coincident biogeographic patterns: Indo-West Pacific Ocean. Evolution 53(2): 326-335.

CITES (Convention of International Trade of Endangered Flora and Fauna). 2002. http://www/cites.org.

Cola, R.M. 1998. Social and institutional assessment for Turtle Islands Integrated Conservation and Development Project. Report submitted to World Wildlife Fund-Philippines Turtle Island Heritage Park Area Project . 95 p. (Unpublished).

Compagno, L.J.V., P. Last, J. Stevens, M.N.R. Alava, J.P.A. Gaudiano, M.M.L. Maypa, B. Samaniego and A. Oliver. Checklist of Philippine Chondrichthyes. 88 p. (In prep.)

Cruz, R.D. 1999. Research, conservation and management of marine turtle in the Philippines. *In* M.T.M. Nasir, A.K.A. Karin and M.M. Ramli. Report of the SEAFDEC-ASEAN Regional Workshop on Sea Turtle Conservation and Management, 26-28 July 1999, Kuala Terengganu, Malaysia. Marine Fishery Resources Development and Management Department, Southeast Asian Fisheries Development Center, Kuala Terengganu, Malaysia.

De Elera, C. 1915. Contribution a la Fauna Filipina. Colegio de Sto. Tomas, Manila, Philippines.

De Veyra, R. and T.D. Ramirez. 1994. Status of marine turtles in the Philippines. *In* K.A. Bjorndal, A.B. Bolten, D.A. Johnson and P.J. Elizar, Compilers. Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFSC-351, 323 p.

Del Valle, L. and M.T. Aquino. 2002. Status and incidence of Irrawaddy by-catch in Malampaya Sound. Abstract. Second International Conference on the Marine Mammals of Southeast Asia, 22-23, 2002, Silliman University, Dumaguete City, Philippines.

Dolar, M.L.L. 1999. A survey of cetaceans and fishery interaction in the Northwestern Sulu Sea and Malampaya Sound, Philippines. World Wide Fund for Nature - U.S. and Silliman University, Dumaguete City, Philippines.

Dolar, M.L.L and C.J. Wood. 1992. Survey of marine mammals in the Central Visayas and Northern Mindanao. Enviroscope 7(8): 1-8.

Dolar, M.L.L. and W.F. Perrin. 1996. Preliminary results on the distribution and abundance of cetaceans in the Philippines. Int. Mar. Biol. Res. Inst. Rep. No. 6: 9-23. Kamogawa, Japan.

Dolar, M.L.L., W.F. Perrin, J.P. Gaudiano, A.A.S.P. Yaptinchay and J.M.L. Tan. 2002. Preliminary report on a small estuarine population of Irrawaddy dolphins *Orcaella brevirostris* in the Philippines. Raffles Bull. Zool. 10: 155-160.

Dolar, M.L.L., S. Leatherwood, C. Wood, M.N.R. Alava, C. Hill and L.V. Aragones. 1994. Directed fisheries for cetaceans in the Philippines. Rep. Int. Whaling Comm. 44:439-449.

Dolar, M.L.L., W.F. Perrin, A.A.S.P. Yaptinchay, S.A.B.J.H. Jaaman, M. Santos, M.N.R. Alava and S.B. Suliansa. 1997. Preliminary investigation of marine mammal distribution, abundance, and interactions with humans in the Southern Sulu Sea. Asian Mar. Biol. 14: 61-81.

Domantay, J.S. 1953. The turtle fisheries of the Turtle Islands. Bull. Fish. Soc. Philipp. 1952-3 (3-4): 3-27.

Eckert, K.L. 1993. The biology and population status of marine turtles in the North Pacific Ocean. NOAA-TM-NMFS-SWFSC-186, 156 p.

Eckert, K.L. and S.A. Eckert. 1989. The leathery turtle. Underwat. Nat. 18(1): 18-24.

Fox, R.B. 1970. The Tabon Caves: Archaelogical expeditions and excavations on Palawan Island, Philippines. Monogr. Nat. Mus. No. 1.

Heaney, L.R., D.S Balete., M.L.L. Dolar, A.C. Alcala, A.T.L. Dans, P.C. Gonzales, N.R. Ingle, M.V. Lepiten, W.L.R. Oliver, P.S. Ong, E.A. Rickart, B.R. Tabaranza Jr., and R.C.B. Utzurrum. 1998. A synopsis of the mammalian fauna of the Philippine islands. Fieldiana (Zool.) 88: 61 p.

Hilton-Taylor, C. 2000. 2000 IUCN Red List of threatened species. World Conservation Union. http://www/redlist.org

Leatherwood, S., M.L.L. Dolar, C.J. Wood, L. Aragones and C.L. Hill. 1993. Marine mammal species confirmed from Philippine waters. Silliman J. 36(1): 65-86.

Marsh, H., H. Penrose, C. Eros and J. Hughes. 2002. Dugong status report and action plan for countries and territories. Early Warn. Assess. Rep. Ser. UNEP/DEWA/RS.02-1.

Milliken, T. and H. Tokunaga. 1987. The Japanese sea turtle trade, 1970-1986. TRAFFIC (Japan) and Center for Environmental Education, Washington D C, USA. 171 p.

Ong, P.S., L.E. Afuang and R.G. Rosell-Ambal, Editors. 2002. Philippine biodiversity conservation priorities: A second iteration of the national biodiversity strategy and action plan. Department of Environment and Natural Resources-Protected Areas and Wildlife Bureau, Conservation International Philippines, Biodiversity Conservation Program-University of the Philippines Center for Integrative and Development Studies and Foundation for the Philippine Environment, Quezon City, Philippines. 113 p.

Palma, J.A. 2002. Policies and updates on the management and conservation of marine mammals in the Philippines. Work. Doc. for the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia, 24-26 July 2002, Silliman University, Dumaguete City, Philippines. CMS/ SEAMAMII/Doc. 26. (Unpublished).

Paul, L. 1994. High seas driftnetting: The plunder of the global commons. http://www.earthtrust.org/dnpaper/contents.html

PCP (Pawikan Conservation Project). 1999. A manual on marine turtle and dugong conservation in the Philippines. 8th ed. Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources, Quezon City, Philippines.

Perrin, W.F. 2002. Can developing countries do anything about bycatch? Terragreen: News to Save the Earth(25): centerpiece.

Perrin, W.F., R.R. Reeves, M.L.L. Dolar, T.A. Jefferson, H. Marsh, J.Y. Wang and J. Estacion, Editors. 2002. Report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia, 24-26 July 2002, Silliman University, Dumaguete City, Philippines. 90 p.

Sala, O.E., F.S. Chapin III, J.J. Armesto, R. Berlow, J. Bloomfield, R. Dirzo, E. Huber-Sanwald, L.F. Huenneke, R.B. Jackson, A. Kinzig, S. Leemans, D. Lodge, H.A. Mooney, M. Oesterheld, N.L. Poff, M.T. Sykes, B.H. Walker, M. Walker and D.H. Wall. 2000. Global biodiversity scenarios for the year 2100. Science 287: 1770-1774.

Seale, A. 1915. Note regarding the dugong in the Philippine Islands. Philipp. J. Sci. X(D.3): 215-218.

Slipjer, E.J., W.L. van Utrecht and C. Naaktgeboren. 1964. Remarks on the distribution and migration of whales based on observations from Netherland ships. Bijdr. Kierdk. 34: 3-93.

Smith, B.D., I. Beasley, M. Buccat, V. Calderon, R. Evina, J. L. del Valle, A. Cadigal, E. Tura and Z. Visitacion. 2002. Status, ecology and conservation of Irrawaddy dolphins, *Orcaella brevirostris,* in Malampaya Sound, Palawan, Philippines. Work. Doc. for the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia, 24-26 July 2002. Silliman University, Dumaguete City, Philippines. CMS/ SEAMAMII/Doc. 14. (Unpublished).

Takashi, M. 1997. TED case studies: Japan driftnet fishing. Trade Environ. Stud. Case Stud. Vol. 5(1): 251 p. and http:// www.american.edu/TED/DRIFTJAP.HTM.

Torres, D.S. 2002. Dugong conservation activities conducted by the Department of Environment and Natural Resources (of the Philippines) from 1991-2002. Work. Doc. for the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of South-east Asia, 24-26 July 2002. Silliman University, Dumaguete City, Philippines. CMS/SEAMAMII/Doc. 22. (Unpublished).

Torres, D.S., I.A. Lim, C.T. Reyes and E. Narida. 2000. Notes on the characteristics of whale sharks *(Rhincodon typus)* in Honda Bay (Palawan, Philippines). Papers in American Elasmobranch Society (AES) Symposium on Natural History during the Sixteenth Annual Meeting of AES, 14-20 June 2000, University Autonoma de Baja California Sur, La Paz, B.C.S., Mexico.

Townsend, C.H. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19(1): 1-50.

Trono, R.B. 2000. Operationalizing a transfrontier management area for sea turtles: The case of Turtle Islands Heritage Protected Area, p. 55-56. *In* H. Kalb and T. Wibbels, Compilers. Proceedings of the Nineteenth Annual Symposium on Sea Turtle Conservation and Biology, 2-6 March 1999. NOAA Tech. Memo. NMFS-SEFSC-443.

WWF (World Wide Fund for Nature)-Philippines. 2003. Proceedings of the Workshop for the Inclusion of Irrawaddy Dolphin (*Orcaella brevisrotris)* Owen in Gray (1866) in the Philippine Red Data List. WWF-Philippines, Quezon City, Philippines.

Yaptinchay, A.A. 1999. New humpback whale wintering ground in the Philippines. Abstracts. *In* Proceedings of the Thirteenth Biennial Conference on the Biology of Marine Mammals, 28 November-3 December 1999, Hawaii, USA.

Philippine Fishing Boats[1]

GLENN D. AGUILAR
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo 5023
Philippines

Background

As you travel the length and breadth of the Philippine archipelago, its coastline has an almost ubiquitous feature - indigenous seacrafts which are mostly small and operated just off the shore. Philippine fishing boats are classified into municipal (3 GT or less) and commercial (greater than 3 GT). Municipal fishing boats may further be classified into nonmotorized and motorized types (Table 1). Commercial fishing boats have three categories: small (over 3-20 GT), medium (over 20-150 GT) and large (more than 150 GT).

A majority of boats are the double-outrigger type of a craft, consisting of a narrow main hull with two attached bamboo outriggers. Commonly called *banca*, this craft may range in capacity from a single person using a paddle or sail for propulsion, to vessels crewed by 30-40 people powered by 250 HP diesel engines. Some medium and most large commercial boats are monohulls, built of steel and usually acquired second-hand (directly from abroad or converted from other craft types). Most improvements of the *banca* have been in the utilization of available materials and technologies for its construction and power requirements. Originally constructed from solid logs where the hull was carved and the interior dug out, the side hulls were replaced through time by plywood when they became abundant (Figure 1). Inboard engines replaced sails as major means of propulsion. Local boat-builders design and build these boats - with designs common to certain geographic areas and made of locally available materials. The main hull consists of a carved log dugout to which marine plywood is attached to form the side planking, and bamboo floats are attached by two or

Table 1. Classifications and principal dimensions of boats commonly used for fishing operations in the Philippines.

Category/Type	Length Overall (m)	GT
Municipal fishing boats		
Nonmotorized	3-7	0.1-0.2
Motorized	5-18	0.5 -2.9
Commercial fishing boats		
Handliner	3-15	3.0-10
Hulbotan (Danish seiner)	10-25	4-30
Basnigan (bagnetter)	15-27	5-20
Trawler	11-22	6-20
Ringnetter	12-25	15-50
Purse seiner	20-50	40-300
Carrier	12-50	10-250

A maritime tradition

Excavations in Butuan City, Mindanao, unearthed 12 vessel artifacts capable of ocean voyages dating back to the 8th century AD. These contribute to evidence that the Micronesian Islands were inhabited by ancestors of the Filipinos with such similarities as rice culture, betel nut chewing and *tuba* or coconut wine.

The Spaniards noted the navigational skill of Filipinos, particularly the Bisaya who used a compass found among the Malays and Chinese. Legaspi, who captured a "Moro" in Butuan, noted that he was "...a most experienced man who had much knowledge, not only of matters concerning these Filipinas Islands, but those of Maluco, Borney, Malaca, Jaba, India, and China, where he had had much experience in navigation and trade" (Blair and Robertson 1973, Vol. II, p. 116).

Such navigational skills would have been developed through a tradition of constant voyaging and exploration where seasonal winds were favorable and literally blew people from one area to another. Historical accounts of early Malay settlement of the islands consistently included ships called *balanghais* that transported *datus* or chiefs from the southern Malay islands.

[1]This paper can be cited as follows: AGUILAR, G.D. 2004. Philippine fishing boats, p. 118-121. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

three transverse booms to the main hull for purposes of stability. Native craft design is so prevalent; crafts even up to 30 m in length overall have double outriggers with semi-dugout hulls. Naturally, dugouts of this size are carved from big tree trunks (Aguilar 1997a, 1997b, 1999a, 1999b).

Indigenous crafts are the most popular fishing platforms mainly because of their affordability. The cost of a boat constructed by local boat-builders is within the means of most fishers. Availability of suitable logs for the dugout hull, bamboo for outriggers and other required materials are further reasons. With double outriggers, the craft tends to provide a stable working platform; the highly buoyant hull materials tend to make the fishers feel safe and comfortable.

Observed disadvantages of such indigenous crafts include a narrow working space, improperly matched propulsion system and a reliance on outriggers for stability. There are other weaknesses in an evolutionary type of design development in which lack of engineering computations is the norm. This is a challenge for designers to determine such deficiencies and work towards improving the safety, durability and efficiency of existing hull forms. Designs exhibit distinct variation throughout the archipelago. Some craft designs could not be found anywhere else except within a certain area. Comparisons show distinct variations between indigenous and modern fishing boats.

The decrease of catches in coastal areas has also resulted in scaled-up versions or bigger vessels of double outrigger types to be able to fish further offshore. Most of these boats, like the small crafts from which they originated, are constructed by traditional boat-builders without the benefit of any engineering or naval architecture design. They are built from experience or skill that has been handed down the generations. The last formal data on municipal fishing boats available were in 1985 with a total of 464,395, up from the last 1980 census of 367,838. If projected to the current year using a growth rate of the five-year period, there would be around 812,000 municipal crafts in 2003. The highest number of motorized and nonmotorized boats is found in Regions IV, V, VII, VIII and IX. For commercial boats, there were 3,211 reported in 1997, increasing to 3,601 in 1999. The most number of boats is found in the National Capital Region followed by Regions XI and VI.

Municipal Fishing Boats

Nonmotorized type

Using either paddle or sail as means of propulsion, nonmotorized boats carry from one to several people depending on the fishing gear used. Paddled boats have the fishers facing the front without any oarlocks. There are some boats (for example, the beach seine boats of Miagao, Iloilo) where rowers face the stern or aft, but in general they face forward and paddle rather than row the boat. For sail-powered boats, fishing is not the only use for them. Regattas or sailing races have lately become popular as tourist attractions. During favorable monsoon weather, popular fishing gears used by sail-powered craft include trolling, handlines and gill nets. Since many *payaos* already exist, it is usual for fishers to sail to *payaos*, tie their boats to these and fish using handlines. When *payaos* are fished by a commercial boat (ringnetter or purse seiner), the fishers using small boats are usually given a few kilos from the large catch of the commercial boat.

Motorized type

Boats with 3-16 HP gasoline or diesel engine are the most common motorized fishing crafts (Figure 2). Usually a Briggs and Stratton or Kohler engine is directly coupled to the shaft to which a two-bladed stainless steel propeller is attached. The rudder is controlled by means of a long pole attached to the rudder arm. Gill nets, handlines, traps, small ringnets and other small gears are usually operated from these boats. Recent innovations include the use of fiberglass to sheath areas of the hull most prone to damage such as exposed decks and side hulls. Some government projects and private individuals have built pure fiberglass hulls using molds. The high price of fiberglass, however, is a major constraint to its widespread adoption.

Commercial Fishing Boats

Small-scale type

Fishing gears, such as trawls, skim nets, ringnets, liftnets and Danish seines, are operated using big outrigger boats of more than 3 GT (Figure 3). Presently, most still operate within municipal waters, depending on the municipality. The control of municipal waters is with the municipality and each has its own system and limitations in implementing regulations. This has resulted in some municipalities being strict and others being not so strict. The areas of jurisdiction of the latter municipalities are now the more popular fishing grounds.

Motors are generally second-hand diesel engines imported from Japan and converted into marine use. Most boats are locally built and with the growing

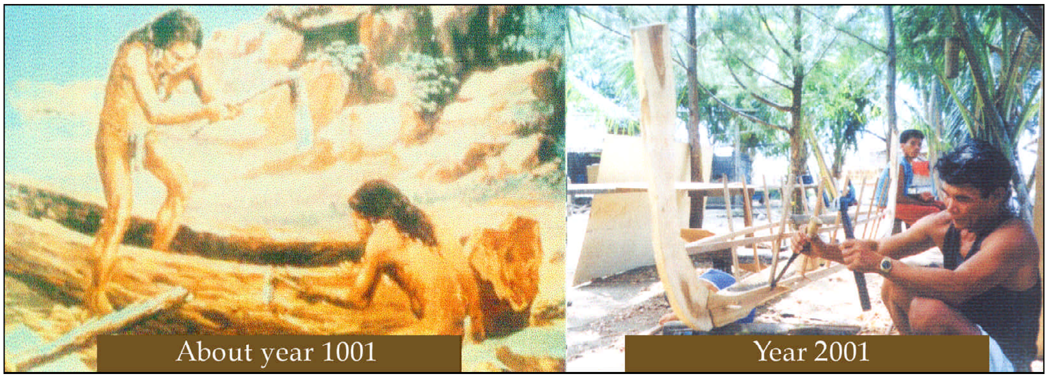


Figure 1. Evolution in construction of small boats in the Philippines.

Figure 2. Typical motorized banca used in many coastal fishing grounds of the country.

Figure 3. Typical small-scale commercial fishing boat.

Figure 4. Typical medium-scale commercial fishing boat.

Figure 5. Typical large-scale commercial fishing boats.

expense of logs used for dugout portion, alternative materials such as fiberglass are being investigated. A number of crafts of this size category also serve as fish carriers - bringing catch from "catcher" boats to the market each morning. Some are also used as "light" boats used for fish attraction and *payao* fishing.

Medium-scale type

There are still outrigger boats in this category (Figure 4), including the *basnig* or liftnet boats, the large Danish seiners or *super hulbot*, medium trawlers and old monohulls fitted with outriggers. Monohulls also exist (both wooden and steel) and most are engaged in ringnet or baby purse seine operations. The operations of fishing crafts in this category are most affected by the 15-km ban on commercial fishing (in terms of number affected and increased cost of operations). A growing number of medium-scale commercial boats are equipped with modern communications and fish finding equipment. It is not uncommon to find global positioning system-equipped fish finders and sonars on board ringnetters. Some *super-hulbot* operations also belong to this category (Aguilar 2000; Shigehiro *et al.* 2001).

Large-Scale Commercial Fishing Boats

Large boats (Figure 5) are mainly engaged in purse seining, with most catchers going for tuna or seasonal small pelagic fishes such as mackerels and roundscads. Most are made of steel and bought second-hand from other countries (Japan, US and Taiwan), although a few are constructed locally. Some are not originally fishing boats and only converted for use in fishing by companies that purchased them. Aside from their old age, such converted boats have altered stability and pose great danger during operations (Sigua and Aguilar 1999).

The mode of operation is mostly fleet-type where a carrier boat is dispatched to several catcher boats located in fishing grounds. The carrier boat loads fish from catchers and brings the catch to ports or processing facilities. In some instances, carrier boats are owned by other companies and the fish are purchased from catchers at fishing ground. There is therefore some difference between fishing ground price and landed price. Large commercial vessels travel all over the archipelago to fish. Landings in Navotas may come from Celebes Sea, Sulu Sea or other areas but are (statistically) recorded as production in the National Capital Region.

Conclusion

The country's boat-building industry remains a backyard (or beachfront) one. There is potential in the development of mass-produced boats that are cheap, safe, efficient, ecologically friendly and acceptable to fishers. When Japan converted to fiberglass-reinforced plastic boats from their traditional boats in the 1950s and 1960s, there was a lot of resistance from fishers. Government workers had to go to the extent of demonstrating the strength of fiberglass-reinforced plastic versus wood by hammering the two hulls and comparing their relative strength. But the main factor that really forced Japanese fishers to change was the increasing costs of wood. Perhaps within the next 10 years, with the country's wood resources running out, the economics of fishing boat construction will force a similar conversion. The opportunity for establishing such an industry is hence quite attractive.

References

Aguilar, G.D. 1997a. Comparative survey of hull forms of indigenous fishing crafts. UPV J. Nat. Sci. 2(1): 20-58.

Aguilar, G.D. 1997b. Computer modelling of indigenous fishing crafts. UPV J. Nat. Sci. 2(1): 59-80.

Aguilar, G.D. 1999a. Current status of research and education and the technological components of the Philippine marine industries. Paper presented at the Roundtable on Marine Transportation. University of the Philippines, Diliman, Quezon City.

Aguilar, G.D. 1999b. Philippine fishing vessels and the Fisheries Code of 1998: Issues and challenges. Proceedings of the Third Japan Society for the Promotion of Science International Conference on Fisheries Science for Tropical Areas: Sustainable Fishing Technology, 19-22 August 1999, Bali, Indonesia.

Aguilar, G.D. 2000. Some marine transport concerns. Public Policy 4(1): 93-119.

Aguilar, G.D., R. Shigehiro and T. Kuroda. 2001. Resistance characteristics of Philippine outrigger fishing craft. UPV J. Nat. Sci. 6: 46-54.

Blair, E.H. and J.A. Robertson. 1973. The Philippine Islands 1493-1895. Vols. 1-55. Manila, Philippines.

Shigehiro, R., G.D. Aguilar and T. Kuroda. 2001. Turning performance of outrigger craft in the Philippines. UPV J. Nat. Sci. 6:55-68.

Sigua, R. and G.D. Aguilar. 1999. Marine transportation and safety, p. 71-86. *In* J. Batongbacal (ed.) Archipelagic studies charting new waters. University of the Philippines Press, Quezon City, Philippines.

Trends and Status of Fish Processing Technology[1]

JASMIN ESPEJO-HERMES
Technology and Livelihood Resource Center
709 City State Centre Building
Shaw Blvd., Pasig City
Philippines

Introduction

Rice and fish are the staple foods in the Philippines contributing 35.1% and 12.3%, respectively, of the total food intake. Fish contributes around 22.4% of the total protein intake of the average Filipino. It is the main source of animal protein in the diet, contributing 56% to the total animal protein intake (FNRI / DOST 1993). The Philippine per capita fish consumption was 26.8 kg / year in 2001 (BAS 2002). There was only a slight fluctuation in average fish consumption during the period 1997-2001 (Table 1). Fish is consumed as fresh, fermented, dried, smoked and canned in the country.

Table 1. Fish supply and use in the Philippines, 1997-2001 (BAS 2002).

Item	Year				
	1997	1998	1999	2000	2001
Total fish supply (t)	2,254,333	2,196,077	2,348,246	2,406,473	2,449,123
Total fish use (t)	2,254,333	2,196,077	2,348,246	2,406,473	2,449,123
Apparent food use (t)	1,894,210	1,837,612	1,984,944	2,034,235	2,088,499
Population	71,145,556	72,581,223	74,045,637	76,498,735	77,925,894
Per capita (kg)	26.62	25.32	26.81	26.59	26.80

Data on the disposition of catch in the Philippines are inadequate. Around 70% of the total catch is consumed fresh or chilled while 30% is processed into cured, canned, frozen products or disposed of live (Abella and Baltazar 1995). The bulk of cured fish and fishery products are consumed locally while only a small quantity is exported as ethnic products. Canned products, particularly tuna, are consumed locally in smaller quantities compared with export volume, and most of the frozen products are for export.

Fish Trade

The Philippines is an exporter as well as importer of fish and fishery products. The balance of trade is negative in terms of quantity, but positive in terms of value. Both exports and imports were lower in 2001 compared to those in 2000.

High-quality and high-valued fishery products are exported to developed countries to earn foreign currency and this reduces the availability and affordability of products such as shrimps and prawns for domestic sale. In 2001, the total export of fish and fishery products was 159,069 t valued at P22.72 billion. The products consisted mainly of fresh and processed fish, crustaceans and mollusks (Table 2). Leading fishery exports were shrimps and prawns, tuna and seaweeds. The major export destinations of shrimps and prawns and tuna were Japan and the USA.

For the past several years, the Philippines has been importing large quantities of pelagic species such as tuna, sardines and mackerel so that various fish processing plants can meet local demand for raw materials (Table 3). The major sources of imported tuna are Papua New Guinea, other Pacific

[1] This paper can be cited as follows: ESPEJO-HERMES, J. 2004. Trends and status of fish processing technology, p. 122-126. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 2. Export of fish and fishery products by kind, quantity and value, 2001(BAS 2002).

Commodity/Kind	Quantity (t)	Value (000 P)
Fish and fish preparations	114,791	18.48
▪ fish - fresh (live or dead), chilled or frozen	41,397	4.30
▪ fish - dried, salted or in brine, smoked (whether or not cooked before or during smoking)	1,534	0.23
▪ crustaceans, mollusks - whether in shell or not, fresh (live or dead), chilled, frozen, salted in brine or dried; crustaceans in shells - simply boiled in water	34,042	9.66
▪ fish and other aquatic invertebrate – prepared, preserved	37,818	4.29
Shells and by-products	2,233	0.65
Miscellaneous and other fishery products	42,045	3.59
Total	159,069	22.72

Table 3. Major fishery product import by kind and quantity (t), 1997-2001 (BAS 2002).

Item	Year				
	1997	1998	1999	2000	2001
Fishmeal	120,056	42,989	73,178	81,237	84,546
Tuna	53,865	69,402	57,287	34,547	19,340
Fresh/chilled/frozen	53,816	69,343	57,261	34,482	19,125
Salted/smoked	-	18	-	21	19
Prepared/preserved	49	41	26	44	196
Mackerel	94,422	41,150	61,074	44,499	23,123
Fresh/chilled/frozen	94,418	41,148	60,980	44,420	23,122
Salted/smoked	1	-	82	24	-
Prepared/preserved	3	2	12	55	1
Sardines	9,457	3,440	38,965	47,804	24,292
Fresh/chilled/frozen	9,138	3,373	38,547	47,546	24,012
Prepared/preserved	319	67	418	258	280
Squid and cuttlefish	9,382	3,358	11,606	17,827	12,760
Fresh/chilled/frozen	-	16	-	-	-
Salted/smoked	8,330	3,315	11,389	17,617	12,580
Prepared/preserved	1,052	27	217	210	180
Total major imports	287,182	160,339	242,110	225,914	164,061
Total imports	295,016	165,989	255,066	242,464	179,994

Islands, Taiwan and Indonesia. Mackerel mostly come from Japan, Taiwan and Korea. In addition, large quantities of fishmeal are imported for feed preparations and the aquaculture industry.

Fish Processing Industry

There is a growing trend towards increased mechanization in operations in the fish processing industry brought about by the need to reduce cost and to manufacture products of consistent quality. There were 488 registered processing plants in the Philippines as of 1999. Majority of these plants manufacture traditional products, such as dried (207 plants) and smoked fish (177 plants) for both foreign and domestic markets. Several plants are engaged in processing of frozen (15 plants) and canned products (14 plants), mainly tuna for export purposes. Around 75 plants manufacture miscellaneous fishery items such as value-added products.

Fresh fish

Old practices of handling the catch are still in place in many fishing communities in the country. However, in areas where the demand for good quality fresh fish, particularly for export, is high, improved methods of handling (proper icing and use of insulated containers) are widely practiced. In all three sectors of fish production - municipal, commercial and aquaculture - the degree of care practiced in handling depends on the market value of the species involved. Species of high commercial value are better taken care of than low value ones. In general, aquaculture products are better handled than those caught in municipal fisheries.

Freezing

There is a growing demand for modern freezing equipment in processing plants that cater to the export market. Contact plate freezers are commonly used for processing shrimps and prawns while air blast and brine freezers are usually employed for tuna. The main frozen products for export are tuna loins (Figure 1), cephalopods, shrimps and prawns.

Figure 1. Loining of tuna for freezing.

Canning

The industry has been making extensive efforts to increase yield and efficiency and to improve product quality, styles of pack and packaging. Majority of the canneries in the country are up to international standards. New equipment is being used in the production line to improve efficiency. In addition to conventional packing media, several new ones have been developed to improve canned products. Variances for canned fish, particularly tuna, that suit the local taste have been made to attract local consumers and to maximize use (Espejo-Hermes 2001). By-products from canning industry find their way into flavoring and fermenting pet food and the fishmeal industry.

Value-added products

A “world on the run” wants food that can be prepared easily or with minimum efforts (Pigott 1994). Value-added products in the form of fillet, comminuted and surimi-based products and ready-to-heat main fish dishes are growing in demand. Locally, comminuted or minced products, such as fish balls, fish sausages, squid balls and fish nuggets are becoming common fare in many supermarkets. The industry absorbs by-catch and market surpluses including farmed species. To date, a shift to the use of farmed species, such as milkfish and tilapia, is gaining ground due to scarcity of raw materials from capture fisheries. A number of processors of deboned milkfish are also converting their by-products to value-added products, such as fish rolls and dumplings to minimize waste. In general, the value-added product industry needs to upgrade its technology and quality standards including hygiene and sanitation in the plants.

Traditional products

Processing of traditional products, such as salted, dried, smoked and fermented fish, is still widely practiced (Figure 2). These products are mainly manufactured by entrepreneurs operating in strategic places in the country where there is a guaranteed supply of raw materials (Espejo-Hermes 1998). The processors are generally small-scale family establishments that have limited capital and do not receive assistance from government agencies and financing institutions. The processing methods they employ vary considerably, thus, resulting in inconsistent quality and limited shelf-life of the finished products. There are very few local processing plants which make use of modern technology (mechanized smokehouses and dryers) and have made progress in upgrading quality standards. Only those which export their products have improved processing practices, equipment, hygiene and sanitation in the plants.

Figure 2. Traditional smoking (Eastern Samar).

Fish Quality and Safety Aspects

Significant changes in the international trade policy, quality and safety criteria have pressured the fish processing industry to improve the products that are being manufactured. Many countries, including the Philippines, have adopted the Hazard Analysis Critical Control Point (HACCP) system for food safety management. Locally, the Joint Management Committee (JMC) has been formed to harmonize accreditation and certification programs of the government on HACCP and the Sanitation and Standard Operating Procedure (SSOP) (Baltazar 2001). The JMC is composed of the Bureau of Fisheries and Aquatic Resources, Bureau of Food and Drugs, Food Development Center and Department of Trade and Industry. Currently, there are 56 plants that are accredited by the European Union (EU) HACCP. These plants export frozen products, such as tuna, shrimps/ prawns and cephalopods, and canned tuna to member-countries of the EU.

Issues and Problems in the Industry

The major and most common problem in the industry is shortage of raw materials. Due to scarcity of raw materials, species such as flatfishes, siganids and mullets which are not traditionally used for processing, are at present not uncommon in the markets. Moreover (and what is even disturbing) is the use of toxic species such as puffer fish for processing. Even juveniles of flatfishes and hairtail are now being processed and even exported. Other problems of the fish processing industry include poor quality raw materials; inconsistent quality of products; lack of appropriate safety standards for traditional products (e.g., unsafe products in relation to use of additives); insufficient capital to improve the enterprise; and lack of appropriate infrastructure (e.g., chilling, cold storage facilities) for the products.

Post-harvest Losses

The extent of losses in post-harvest fisheries is difficult to quantify. Locally, an estimated loss of about 25-30% of the total catch is incurred due to improper handling (Camu 1991). Based on observation, Kamari and Sayers (1979) estimated that up to 30% of some fish species landed at Navotas had suffered some physical damage prior to auctioning. On a global scale, several reviews have included estimates of total losses, and typical figures are shown in Table 4.

At first glance, post-harvest losses seem simple. A quantity of fish is harvested but a smaller amount reaches the consumer. However, the actual situation is far from simple. Losses are not only a matter of quantity of material. Losses in terms of economic value must be considered, which means the monetary worth of fish through handling, processing, distribution and marketing cycle (Ames

Table 4. Underutilization of conventional fish stocks (Ames *et al.* 1991).

Type of Fish	Form of Loss	Million t/Year
Wet	Post-harvest	2
Cured	Post-harvest	3
By-catch	Discarded at sea	5-20
Pelagic	Used for fishmeal	20
	Underexploited	20

1992). Post-harvest losses of fish can be of various types: material or physical, economic and nutritional.

Physical losses

Physical losses of fish after catching can be viewed in two distinct ways. First, there is what might be termed complete loss. Quantities of fish may spoil completely, thus becoming entirely inedible. By-catches from shrimp and tuna fishing are thrown overboard. Related to these losses is the underutilization of resources where small fish are converted into fishmeal instead of being used for human food. Furthermore, there are less popular fish that are rarely used for human consumption. Second is what can be considered as loss of material which results from poor handling and processing of both fresh and processed fish.

Economic losses

The economics of post-harvest losses is a complex topic (Anderson 1988). Unlike physical losses, value or economic losses are difficult to measure. These are gradual, progressive and subjective; different groups of people may hold different views of the “worth” or value of a particular product. The losses of material will certainly involve a loss in value, as the fisher, processor or distributor has less weight of material to sell. Spoilage of wet fish is accompanied by loss in value. Dried fish, which has been attacked and partly eaten by insects, will be less attractive to buyers than undamaged fish and its price will usually be lower. Economic losses could occur during trading in the international market due to rejection.

Nutritional losses

Fish is perishable and as it spoils, its nutritional value decreases. Nutritional losses also occur during processing particularly in traditional methods, such as smoking, salting and drying. Traditional processing methods can cause loss of nutrients, when fish muscle constituents, although still physically present, are not utilized by the human body.

Reducing losses

Much can be achieved by simple improvements in handling and processing methods. The basic requisite is to take better care of harvested fish by using sufficient ice and appropriate containers for chilling and of processed fishery products through improved processing, packaging and storage methods as well as efficient marketing practices.

References

Abella, F. and C. Baltazar. 1995. Status of fisheries trade and post-harvest activities in the Philippines. Paper presented at the Second National Fisheries Workshop on Policy Planning and Development, 22-23 November 1995, Quezon City, Philippines.

Ames, G. 1992. The kinds and levels of post-harvest losses in African inland fisheries. *In* F. Teutscher (ed.) Proceedings of the Symposium on Post-harvest Fish Technology, 21-22 October 1990, Cairo, Egypt. CIFA Tech. Pap. 19, 117 p.

Ames, G., I. Clucas and S.S. Paul. 1991. Post-harvest losses in the tropics. Natural Resources Institute, University of Greenwich, Kent, United Kingdom. 23 p.

Anderson, J.L. 1988. Economics and seafood quality. *In* M. Morrissey (ed.) Post-harvest fishery losses. International Center for Marine Resource Development, Rhode Island, USA.

Baltazar, C.C. 2001. Fish quality, safety and management system. *In* ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: Fish for the People, 19-24 November 2001, Bangkok, Thailand.

BAS (Bureau of Agricultural Statistics). 2002. Fisheries statistics of the Philippines 1997-2001. BAS, Department of Agriculture, Quezon City, Philippines. 81 p.

Camu, C. 1991. Status of Philippine fish processing industry, p. 103-113. *In* K. Hoo, K. Miwa and M.B. Salim (eds.) Proceedings of the Seminar on Advances in Fishery Post-harvest Technology in Southeast Asia, 6-11 May 1991, Singapore. Marine Fisheries Research Department, Southeast Asian Fisheries Development Center, Singapore.

Espejo-Hermes, J. 1998. Fish processing technology in the tropics. Tawid Publications, Quezon City, Philippines. 336 p.

Espejo-Hermes, J. 2001. An overview on fish post-harvest industry in the Philippines. *In* FAO Training on Fish Processing and Quality and Safety of Fishery Products, April-June 2001, Institute of Fish Processing Technology, College of Fisheries and Ocean Sciences, University of the Philippines in the Visayas, Iloilo, Philippines.

FNRI/DOST (Food and Nutrition Research Institute/Department of Science and Technology). 1993. Fourth National Nutrition Survey. FNRI/DOST, Bicutan, Philippines.

Kamari, A. and J.C. Sayers. 1979. The use of standard returnable fish containers in ASEAN countries. ASEAN-Australia Economic Cooperation Food Handling Project, Sydney, Australia. 171 p.

Pigott, G. 1994. Who is the 21st century consumer? INFOFISH Int. 1(94): 12-30.

Economics of Fisheries Management in the Philippines[1]

RALPH TOWNSEND[2]
University of Maine
Orono, ME 04473
USA

Effective fisheries management in the Philippines must address the underlying economic incentives to overexploit fisheries resources. Because a fishery is an open access resource, too many fishers are attracted to it. These additional fishers cause the stock of fish to be reduced; the reduction in the stock leads to lower yields in the long run. This is a classic case of Hardin's (1968) "tragedy of the commons". The only way to reverse this situation is to reduce the number of fishers.

Habitat improvement alone cannot restore fish stocks and increase average fisher incomes. If habitats were restored *and* the number of fishers remained the same, then fishers could benefit from the improved environment. But with open access, improved fisheries attract more fishers. Given a large underemployed population and rapid population growth, there will be no shortage of new fishers in the Philippines as stocks improve. The stocks will revert quickly to their overfished status.

A model that incorporates both biology and economics, the Schaefer (1957)-Gordon (1954) model, explains how economic incentives interact with renewable fishery systems. The inevitable result is overexploitation of open access resources. Schaefer's (1954) yield-effort curve is presented in Figure 1. This curve represents the long run equilibrium between the level of fishing effort and the catch that can be sustainably removed each year. This curve has an

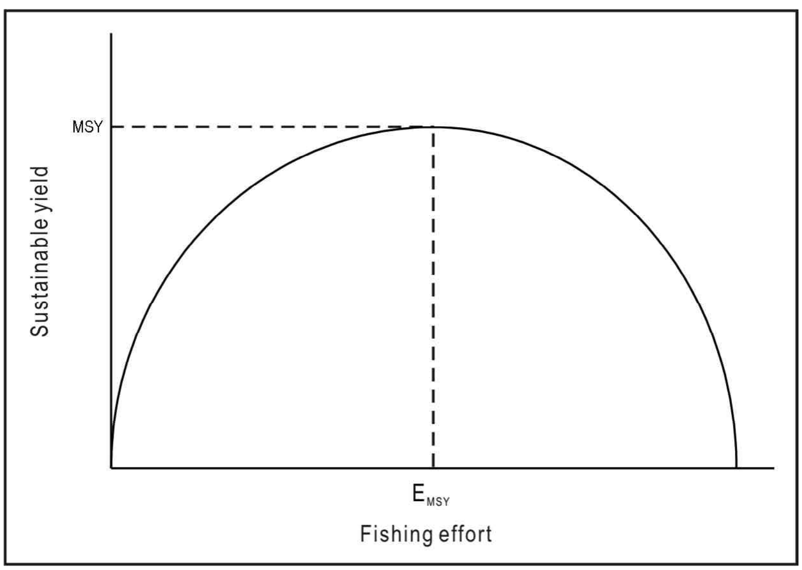


Figure 1. Schaefer yield-effort curve.

[1] This paper can be cited as follows: TOWNSEND, R. 2004. Economics of fisheries management in the Philippines, p. 127-130. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] The author was a Visiting Professor in 2002 at the Institute of Marine Fisheries and Oceanology, College of Fisheries and Ocean Sciences, University of the Philippines in the Visayas.

inverted U-shape because effort has two effects. More effort increases the percent of the stock that is caught, so more effort always increases total catch in the short run. But the increases in catch reduce the stock of fish and therefore its ability to grow and reproduce. At effort level E_{MSY}, the maximum sustainable yield (MSY) can be harvested each year in perpetuity, and this is the highest production that can be sustained from the fishery. Beyond the MSY level of effort, extra effort reduces the stock enough to lower the total sustainable yield even with more fishing effort.

In Figure 2, the yield-effort curve has been multiplied by a fixed price per kilogram to yield a total revenue curve. The U-shape is unchanged when multiplying by a constant price. The total cost line is the cost per unit of effort times the amount of fishing effort. A constant multiplied by the variable on the x-axis yields a straight line through the origin. The sustainable revenue and total cost curves explain the economic incentives that attract too many fishers. More effort is attracted to an open access fishery as long as revenues earned by fishers exceed their costs. The extra income that attracts more fishers only disappears when total revenues fall enough to equal total costs, at effort level E_{OA}, the open access equilibrium.

Open access fisheries attract too much fishing effort, so optimal regulation must reduce fishing effort. Economists have proposed two management approaches: limited entry (Sinclair 1961) and individual transferable quotas or ITQs (Christy 1973; Maloney and Pearse 1979). Under limited entry, the number of fishing permits or licenses is restricted to the number consistent with optimal stock productivity. Under ITQs, the government establishes an overall quota that protects the stocks. Each permit holder gets a predetermined share of this quota. The quota holder is then free to fish that quota, lease the quota to someone else, lease additional quota from other quota holders, and buy or sell the permanent right for future quota shares. Limited entry and ITQ systems have been implemented throughout the developed world. The prices of limited entry licenses and the lease value of ITQs show that fish stocks are extremely valuable. These values, converted to the Philippine context for municipal fishers, suggest that restricting effort could raise fisher incomes by something in the range of 100-400%.

In many fisheries, limited entry presents some difficult administrative problems because each permit has an incentive to expand its own fishing capacity (Townsend 1990). While there are ways to manage this expansion of fishing capital per license, the problems can be administratively difficult. Because of these problems, fishery economists have tended to favor ITQs. But ITQs require aggressive enforcement of fishing quotas, which may be difficult for governments with weak law enforcement and judicial institutions.

Restricting one part of the fishing fleet does not constrain the overall level of fishing effort. Other sectors of the fleet will have economic incentives to expand, which will bring the industry back to the open access equilibrium. The commercial fleet in the Philippines has faced increasing restrictions; this may in part reflect a tendency to blame the commercial fleet for overfished stocks. But evidence from around the world clearly indicates that many small boats with passive gear can reduce stock levels just as much as large vessels. The

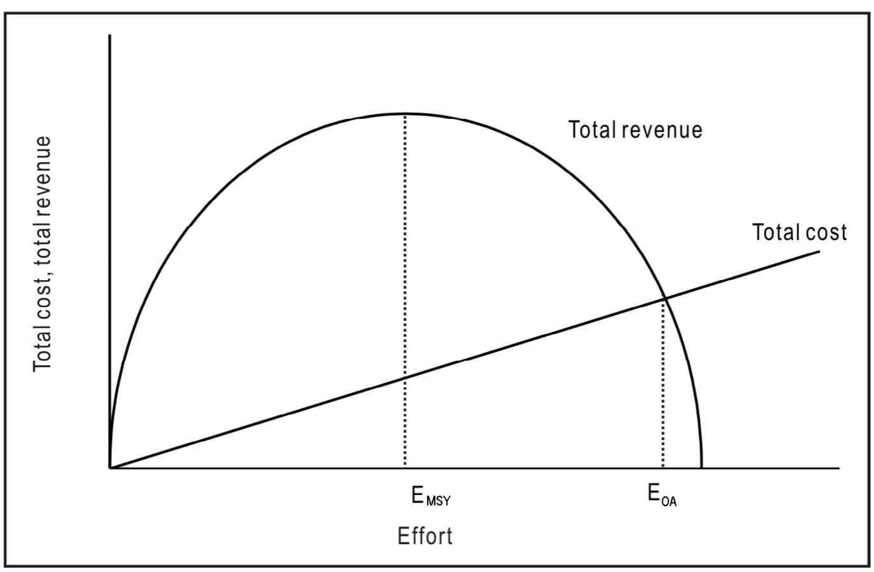


Figure 2. Schaefer-Gordon revenue-cost model.

degree of overfishing under open access is limited only by the cost of fishing, which includes the value of the fisher's time. In the municipal fisheries of the Philippines, the value of time for new entrants is very low, perhaps in the order of P100-200 per day. Even catch rates as low as 1 or 2 kg per day are sufficient to attract more fishers. A large and growing population with low income opportunities is sufficient to insure seriously overfished stocks.

Much of fisheries management in the Philippines has been devolved to local communities. In some fisheries around the world, small groups of fishers adopt local forms of limited access. If local communities can restrict fishing effort effectively, then fisher incomes will increase. But restricting effort is probably not any easier for local politicians than for national ones. Even if communities are allowed to deny access to nonresidents (the easy political choice), it will be politically much more difficult to restrict entry from within the community. Population growth rates of 2.5-3.5% per year provide more than enough new fishers to deplete resources. (At 2.5% annual growth, a community doubles every 30 years. At 3.5%, it doubles in only 20 years.) Allowing and encouraging local government units to restrict access is highly desirable. But simply moving management to the local level probably does not make the solution easier to achieve.

The Schaefer-Gordon model explains why habitat improvements (including any beneficial stock effects of marine protected areas) alone will not result in sustainable income increases. A restored habitat will have the capacity to produce more fish at any given level of effort. In Figure 3, the sustainable total revenue curve shifted from curve TR_1 to curve TR_2 as habitat improved. If the number of fishers stayed at effort level E_1, then the fishers would see their revenues increase dramatically. But under open access, more fishers will enter to share in these profits. This new entry will continue until total revenue again equals total cost, at effort level E_2. Total revenues will have increased moderately, but no single fisher is better off. There are just more fishers earning the barest of incomes. The opportunity to combine habitat improvement with a ban on new entry would require less (or perhaps even no) reduction in the current level of fishing effort. With better habitat, something like the current number of fishers might be supported at much better income levels. This is politically much more attractive than having to make large reductions in the number of fishers. So the time to restrict effort is before, not after, investments are made in habitat restoration and before, not after, stock improvements are offset by more entry.

The Philippines has both a great economic opportunity and a very difficult political challenge. If the fishing effort is reduced to optimal levels, fisheries resources are capable of producing fish at a very low cost. This could generate significant increases in the incomes of some - but not all - fishers. But it is politically very difficult to tell some fishers that they must leave the fishery so other fishers can gain the benefits. The current initiatives in Philippine fisheries management, which include devolution of authority to local governments, restricting commercial vessels (only) and habitat improvement/marine protected areas, all fail to address the underlying incentives for fishers to enter until the stock is depleted. Only if these policies are combined with programs to restrict entry can the potential wealth of Philippine fisheries be released to

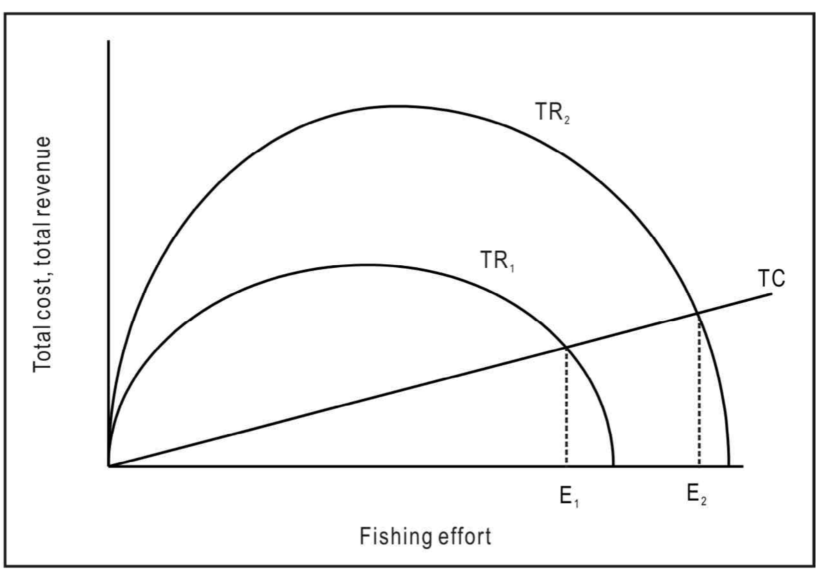


Figure 3. Habitat restoration under open access.

Limited fishing effort		Open access
Economics		Economics
Higher average incomes Fewer fishers Higher total income	**versus**	Lower incomes More fishers Lower total income
Stocks		Stocks
Larger stocks More diversity in size of fish More resilient stocks		Smaller stocks Mostly small fish Stocks vulnerable to external shocks

Figure 4. Choices facing fisheries management in the Philippines.

improve the economic welfare of its fishing communities. Figure 4 summarizes the difficult choice facing fisheries management in the Philippines. The highly desirable features of the limited entry regime can be achieved only by limiting fishing effort. Unfortunately, restrictions on who can fish require difficult political and social choices. Absent this choice, the Philippines will continue to suffer the negative impacts of open access (Figure 4).

References

Christy, F., Jr. 1973. Fisherman quotas: A tentative suggestion for domestic management. Occas. Pap. 19, 7 p. Law of the Sea Institute, University of Rhode Island, Rhode Island, USA.

Gordon, H.S. 1954. The economic theory of a common-property resource. J. Polit. Econ. 62: 124-142.

Hardin, G. 1968. The tragedy of the commons. Science 162: 1243-1248.

Maloney, D.G. and P.H. Pearse. 1979. Quantitative rights as an instrument for regulating commercial fisheries. J. Fish. Res. Board Can. 36: 859-866.

Schaefer, M.B. 1954. Some aspects of the dynamics of populations important to the management of the commercial marine fisheries. Bull. I-ATTC 1: 25-56.

Schaefer, M.B. 1957. Some considerations of population dynamics and economics in relation to the management of the commercial marine fisheries. J. Fish. Res. Board Can. 14: 669-681.

Sinclair, S. 1961. License limitation: A method of economic fisheries management. Department of Fisheries, Ottawa, Canada.

Townsend, R.E. 1990. Entry restrictions in the fishery: A survey of the evidence. Land Econ. 66: 359-378.

Economics and Environment in the Fisheries Sector[1]

DANILO C. ISRAEL
Philippine Institute for Development Studies
NEDA sa Makati Bldg., 106 Amorsolo St.
Legaspi Village, Makati City 1229
Philippines

Introduction

This paper provides a broad description of the economic and social characteristics of the Philippine fisheries sector. The sector contributes to production, income generation and international trade. Two economic facets are portrayed here: the private sector, which generates positive profits, and the municipal fisherfolk, who remain poor despite many interventions in the sector. One of the reasons for the continuing drop in income is declining catch. The final section of this paper explains the overfishing phenomenon and relates it to habitat destruction. Some estimates of losses and potential earnings from critical coastal habitats are also provided.

Economic Importance of the Fisheries Sector

The fisheries sector, on average annually, had a total value of production of P77.39 billion for the period 1990-2000, accounting for an average of 4% of gross domestic product (GDP) for the same period (Table 1). However, percentage fisheries production in relation to GDP has been generally declining over time and reached about 3% in the year 2000. For the period 1990-2000, annual fisheries production growth rates were low and erratic, especially in terms of volume (Table 2). Furthermore, the average annual growth rates for the sector were generally higher in the earlier years than in the latter years of the period, indicating the fall in relative productivity over time. For both volume and value, growth rates were positive but generally declining for the entire period and were negative for a few years, particularly 1996 and 1997.

Of the three fisheries subsectors, municipal fisheries performed the worst in recent years. In 2000, the municipal fisheries subsector was the least producing in terms of volume (BFAR 2001). For its part, the aquaculture sector has been the most encouraging in terms of production performance. From being the lowest producer in 1990 in terms of volume, it became the highest producer in 2000.

Regionally, total fisheries production varied significantly. In 2000, the largest regional producer was the Southern Tagalog Region (Region IV) while the least was the landlocked Cordillera Autonomous Region. In terms of species, fisheries production also varied significantly. In 2000, the most important commercial fisheries species volume-wise was roundscad, the most significant municipal species was frigate tuna and the largest aquaculture product was seaweed.

The most significant fisheries export in 2000 was tuna, in volume terms, and shrimp and prawn, in value terms. Seaweed was another important traded fisheries commodity. Except for a few products like canned tuna, most of the exported fisheries commodities were in fresh and frozen form and have undergone little product transformation and processing. Also in 2000, the most important imported fisheries products were

Table 1. Fisheries production and GDP of the Philippines, 1990-2000 (P million, current prices) (NSCB 2002).

Year	Fisheries Production	GDP	% Fisheries Production to GDP
1990	52,177.2	1,077,237	4.84
1991	60,033.3	1,248,011	4.81
1992	65,443.5	1,351,559	4.84
1993	70,215.8	1,474,457	4.76
1994	80,192.1	1,692,932	4.74
1995	83,187.3	1,905,951	4.36
1996	83,275.2	2,171,922	3.83
1997	80,617.1	2,426,743	3.32
1998	85,133.1	2,665,060	3.19
1999	92,322.3	2,976,905	3.10
2000	98,657.6	3,308,318	2.98
Average	77,386.8	2,027,190	4.07

[1] This paper can be cited as follows: ISRAEL, D.C. 2004. Economics and environment in the fisheries sector, p. 131-137. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 2. Fisheries production in the Philippines, total volume and value, 1990-2000 (BFAR 1999, 2001).

Year	Volume (t)	Annual Growth Rate (%)	Value (P Million)	Annual Growth Rate (%)
1990	2,503,546	-	52,177	-
1991	2,598,981	3.81	60,034	15.06
1992	2,625,607	1.02	65,443	9.01
1993	2,631,945	0.24	70,215	7.29
1994	2,720,989	3.38	80,192	14.21
1995	2,785,085	2.36	83,084	3.61
1996	2,769,150	-0.57	83,134	0.06
1997	2,766,507	-0.10	80,711	-2.91
1998	2,786,335	0.72	84,864	5.15
1999	2,918,779	4.75	91,190	7.45
2000	2,983,058	2.20	98,195	7.68
Annual averages				
1990-2000	2,735,453	1.78	77,204	6.66
1990-1995	2,644,359	2.16	68,524	9.84
1996-2000	2,844,766	1.40	87,619	3.49

chilled frozen fish, particularly tuna, sardines and mackerel. Most of the imported tuna were utilized as raw materials in the processing plants in Mindanao while the other species were consumed directly as food. The other products imported were generally used as raw materials in the production of fish feed. In general, both fisheries exports and imports grew during the 1990-2000 period with the average annual growth rate higher in the earlier part of the decade than in the latter part.

The Philippines ranked third in capture fisheries production, fourth in aquaculture production and third in total fisheries production among the countries in the Association of Southeast Asian Nations (ASEAN), in terms of volume (ADB 2001; FAO 2002). The production levels of the country were also higher than the ASEAN average for the entire fisheries sector and its subsectors. Indonesia and Thailand ranked first and second in fisheries production, respectively, for fisheries in totality and for capture fisheries and aquaculture.

The Role of the Private Sector

The most recent national survey data on industrial and business establishments in the fisheries sector were those coming from the annual survey of establishments for 1997 (BFAR 1997). The total number of firms in the sector was more than 800 including those with more than 10 and less than 10 workers (Table 3). This total includes only firms and did not cover the municipal and sole-operating fishers and other operators. The firms in the fisheries sector with more than 10 workers had total revenues of about P5.6 billion, total costs of P3.7 billion and net revenues of P1.9 billion while the firms with less than 10 workers had total revenues of approximately P231 million, total costs of P168 million and net revenues of P62 million.

Total employment of the firms in the fisheries sector was at 25,762 persons for those with more than 10 workers, composed of 23,859 males (93%) and 1,903 females (7%). For firms with less than 10 workers, total employment was 1,936 persons, made up of 1,677

Table 3. Important economic parameters for fisheries firms, 1997 (BFAR 1997).

Economic Parameter	Unit of Measurement	Firms with Workers 10 or More	Firms with Workers Less than 10
Number of establishments	Firms	501	347
Total revenues	P1,000	5,558,079	230,708
Total costs	P1,000	3,652,717	168,630
Total net revenues	P1,000	1,905,362	62,078
Total employment	Persons	25,762	1,936
Total male employment	Persons	23,859	1,677
Total female employment	Persons	1,903	259

males (87%) and 259 females (13%). Females therefore made up only about 10% of the total workforce of firms in the fisheries sector. However, while so, it should be noted that if households and individuals and not just firms were included in this survey, a much higher percentage of women were involved in fisheries, due to their higher participation in the processing and marketing portions of the industry.

For the entire fisheries industry, data on private sector employment that included individual fishers and similar operators did not exist. Nevertheless, it is certain that the sector has been a major source of employment and livelihood for a large section of the population, especially those residing in the rural coastal areas. As of 1996, it was estimated that the country had about a million fishers and fishfarmers (Israel and Roque 1999). Of this number, 68.19% were in municipal fisheries, 26.09% were in aquaculture and 5.72% were in commercial fisheries. In addition, approximately 12% of the general population derived their livelihood from fisheries-related activities (Trinidad *et al.* 1993). This large and diverse constituency makes fisheries an economically, socially and politically important sector of the entire economy.

In 1999, there were 3,601 units of commercial fishing vessels in the country with a total tonnage of about 270,282 GT (Table 4). Most of the vessels were based in the National Capital Region (NCR) and in Regions XI, VI and IX. The vessels did not fish only where they were based but went to other regions as well. Commercial fishing used more complicated fishing gears compared to municipal fishing. Among the most important of these were the aggregating devices for pelagic fish species known as the *payao*, purse seines, longlines, trawl nets, fish traps and similar devices employed for large-scale fishing operations (CMC 2003).

Table 4. Number of commercial fishing vessels by region, 1999 (BFAR 2001).

Region	Number	Gross Tonnage
NCR	1,351	158,510
I	113	1,833
II	64	718
III	40	1,081
IV	221	3,857
V	160	4,386
VI	404	25,674
VII	94	2,054
VIII	124	1,740
IX	392	22,759
X	43	1,215
XI	555	45,894
XII	7	85
XIII	26	294
ARMM[a]	7	182
Total	3,601	270,282

[a]ARMM - Autonomous Region of Muslim Mindanao.

In addition to production, processing is an activity in the fisheries industry where the private sector is highly active. For instance, entrepreneurs have practiced simple forms of primary fish processing. In particular, some fish are first filleted, chilled and then sold in markets. Others are simply cleaned and then sold fresh either head-on or headless and in full or in parts. More sophisticated processing has been practiced by the private sector as well, particularly in cases where fish products require time to sell and must be preserved. A popular form of processing is salting that produces fish paste *(bagoong)*. This product is either produced by big companies in the cities and sold in bottled form in supermarkets or by small-time entrepreneurs in the provinces and sold openly and by weight in town markets. Other forms of processing that are also done by small-scale entrepreneurs in the coastal countryside are fish drying and fish smoking.

On a large-scale, tuna and sardine canning is practiced by the private sector in the country, particularly in General Santos City in Southern Mindanao and a few other areas. The seaweed processing industry is also an important private sector activity, where seaweeds produced by growers are usually dried and sold to industries which in turn export the processed products to other countries.

Socioeconomic Conditions of Fisherfolk

A comparison of income and social standing of fisherfolk households indicates that the poverty situation remains unchanged from the time Smith (1979) and Librero *et al.* (1985) conducted studies of municipal fishers. After the first major fishery sector project (Fishery Sector Project [FSP], 1990-1994), PRIMEX (1996) noted that 80% of fisherfolk households were still below the poverty threshold despite major interventions ranging from full investment packages for fishing boats and equipment to community-based coastal resource management.

The latest family income and expenditure survey (NSO 2001) indicated that economic and social parameters for fisherfolk households[2] reinforce this

[2] It is assumed that fisherfolk households include both commercial and municipal fishers.

observation. The data showed that in 2000, households whose heads were fishers had significantly higher poverty incidence than households in general (Table 5). Furthermore, the average annual income of fishers' households and those who work in the fishing industry was about P70,000, half of the average annual income of households in general at approximately P144,000. This translates to an average daily income of around P192 or roughly, the retail value of 2 kg of fish. Low incomes can be attributed to declining fish catch, estimated to be about 2 kg per day, down from 20 kg per day, which was the average catch during the 1970s (CRMP 1998; Katon *et al.* 1998). The data further showed that the difference in poverty incidence and annual income between families whose heads were fishers and those whose heads worked in the fishing industry (for example, as boat hand, engineer, cook, accountant) was small, manifesting the deprived conditions which households in the fishing industry were generally in compared to all households in the country.

Because of low-income levels, a greater portion of the incomes of fishers' households was spent on food expenditures and a much lesser share was used for other items, compared to the incomes of households in general. It is interesting to note that fishers'

Table 5. Socioeconomic characteristics of households in the Philippines, 2000 (NSO 2001).

Household Characteristic	% Households whose Heads are		All Households (%)
	Fishers	In Fishing Industry	
Poverty incidence[a]	61.9	59.9	33.7
Distribution of households by educational attainment of the head			
No grade completed	6.5	4.3	4.1
Elementary undergraduate	76.4	77.9	53.3
Elementary graduate	12.3	12.7	20.3
1st-3rd year high school	3.4	3.6	10.6
High school graduate	0.3	0.3	1.2
College undergraduate	0.2	0.1	0.7
At least college graduate	0.9	1.2	9.8
Access to safe water	61.8	65.8	78.5
Access to sanitary toilet facility	51.5	54.2	82.5
Access to electricity	51.2	55.5	75.4
Proportion living in makeshift houses	2.8	2.7	2.0
Proportion who are squatting	5.9	6.1	3.1
Mean family size (number)	5.6	5.6	5.1
Mean income	70,244	72,959	144,039
Mean expenditure	62,445	64,297	118,002
Expenditure pattern			
Total household expenditure	100.0	100.0	100.0
Food	59.3	58.5	43.6
Alcoholic beverages	1.2	1.3	0.7
Tobacco	2.4	2.4	1.1
Fuel, light and water	5.9	6.0	6.3
Transportation and communication	3.2	3.4	6.8
Household operations	18.4	18.4	23.2
Personal care and effects	3.5	3.5	3.6
Clothing, footwear and other wear	2.4	2.4	2.7
Education	2.3	2.3	4.2
Recreation	0.2	0.3	0.5
Medical care	1.2	1.3	1.9
Nondurable furnishings	0.3	0.3	0.2
Durable furniture and equipment	1.4	1.5	2.5
Taxes	0.4	0.4	2.1
House rent	7.9	7.8	14.2
House maintenance and minor repairs	0.9	0.9	0.9
Special family occasions	1.7	2.0	2.4
Gifts and contributions to others	0.9	0.8	0.9
Other expenditures	2.9	2.9	2.9

[a]Proportion of families whose per capita income cannot meet the minimum food and nonfood requirements.

households had a relatively higher rate of spending on vices, like alcohol and tobacco, and less on taxes than households in the country in general.

Households of fishers and those in the fishing industry also had heads with relatively lower education levels compared to households in general. More than two-thirds of fishing households had heads that were elementary undergraduates. In contrast, only about half of households in the country in general had heads that were similarly educated. Fishers' households had lower access rates to basic necessities like safe water, sanitary toilets and electricity than other households and were more likely to live in makeshift houses or were squatting. Also, the size of households of fishers and of those in the fishing industry was greater than the national average.

Associated Environmental Problems

Arguably the most important management issue in the fisheries sector is overfishing. Fishing levels have already exceeded what ensured maximum productivity of fish stocks. The main causes of depletion were effort overfishing or the increase in the number of fishers exploiting the seas, particularly in coastal waters, and destructive fishing or the use of illegal fishing gears and methods. The economic cost of overfishing or the so-called net rent has been estimated in the literature (NSCB 1998). Rent dissipation started to occur in 1986 at a mere P4.5 million (Table 6). By 1993, this ballooned to about P1 billion which is certainly a big loss to the fishery sector. Studies have likewise estimated sustainable yield levels and dissipated rents for the small pelagics and demersal fishery (Dalzell *et al.* 1987; Silvestre and Pauly 1989; Trinidad et. al 1993; Padilla and de Guzman 1994).

Declines in fish catch can also be attributed to destruction of critical coastal habitats, such as mangroves and coral reefs. In 1918, mangroves covered about 500,000 ha (Melana and Courtney 2000) but this went down to 288,000 ha in 1970 and to 175,000 ha in 1980. The rapid decline of mangrove forests has been attributed to the significant conversion of mangrove areas to fishpond and other aquaculture activities, land reclamation, construction of dikes and other coastal structures, wood extraction and uncontrolled development of tourism.

White and Cruz-Trinidad (1998) conducted some economic analysis to measure the benefits that can be derived from the management of mangrove areas. Three management scenarios were compared: mangrove plantation, managed naturally regenerated mangroves and unmanaged understocked stands (Table 7). They computed that the net annual economic value that can be derived from Philippine mangrove areas per hectare would be highest with mangrove plantation ($694) compared to the managed naturally regenerated mangroves ($628) and unmanaged understocked stands ($580). In all three management schemes, fish products significantly contributed more to the economic value generated from the mangrove areas than the wood products. Based on their computations, White and Cruz-Trinidad (1998) asserted that the total gains from protecting the remaining mangrove ecosystem of the country would be substantial. They estimated that using the conservative figure of direct benefits from mangroves of $600 per hectare per year, the country would generate at least $83 million per year in fish production and potential sustainable wood harvest from the existing 138,000 ha or so.

The destruction of coral reefs is another major problem. The national coral reef area was estimated at about 27,000 km^2 and contributed at least 10-15% of the total marine production (NEDA 1998). Out of 742 coral reef sites once surveyed in 1991, only 5.3% or 39 sites were in excellent condition while 30.5% or 226 were in poor condition (EMB 1996). The destruction of the coral reefs was attributed to many factors including siltation, mine tailings, pollution, coastal development,

Table 6. Estimated value of marine fishery resource depletion, 1985-1993 (NSCB 1998).

Year	Fishing Effort (HP)	Sustainable Catch (t)	Actual Catch (t)	Depletion[a] (t)	Net Price (P/t)	Net Rent (P '000)
1985	649,477	1,622,976	1,556,542	0	0	0
1986	650,655	1,622,318	1,624,206	1,888	2,391	4,513
1987	653,145	1,620,911	1,688,926	68,015	2,159	146,845
1988	611,119	1,641,475	1,726,033	84,558	2,223	187,939
1989	561,349	1,655,890	1,823,409	167,518	2,183	365,741
1990	548,115	1,657,639	1,914,725	257,086	2,230	573,224
1991	455,734	1,640,049	2,008,007	367,957	2,543	935,700
1992	380,379	1,577,501	1,991,463	413,963	2,671	1,105,772
1993	405,231	1,603,754	1,978,350	374,596	2,866	1,073,460

[a]Actual catch less sustainable catch.

Table 7. Estimated net annual economic value (in $/ha) of mangrove areas for different levels of management, Philippines (White and Cruz-Trinidad 1998).

Level of Management	Products (value/ha) Wood	Fish	Total (value/ha)
Mangrove plantation	156	538	694
Managed, naturally regenerated	90	538	628
Unmanaged, understocked stands	42	538	580

Table 8. Sustainable annual economic benefits (direct and indirect) per 1 km^2 of typical healthy coral reef with tourism potential, Philippines (White and Cruz-Trinidad 1998).

Resource Use	Production Range	Potential Annual Revenue Range ($)
Sustainable fisheries (local consumption)	10 - 30 t	15,000 - 45,000
Sustainable fisheries (live fish export)	0.5 - 1 t	5,000 - 10,000
Tourism (onsite residence)	100 - 1,000 persons	2,000 - 20,000
Tourism (offsite residence)	500 - 1,000 persons	2,500 - 5,000
Coastal protection (prevention of erosion)		5,000 - 25,000
Aesthetic/biodiversity value (willingness to pay)	600 - 2,000 persons	2,400 - 8,000
Total		31,900 -113,000

overfishing and destructive fishing practices like the use of cyanide, dynamite and muro-ami.

Coral reefs are important because of their various economic and other contributions, particularly in terms of productivity of fish and other sea products, tourism and recreation, natural protection to shoreline structures from waves and storms, and biodiversity. White and Cruz-Trinidad (1998) cited that the contribution of reef fish to total fisheries of the country ranged from 8-20% and can sometimes go as high as 70% in some small island fisheries. They further estimated that the total quantifiable net losses due to overfishing 1 km^2 of coral reef over a 25-year period and discounted at 10% were about $108,900; those due to poison fishing were between $42,800 and $475,000; those due to blast fishing were between $98,000 and $761,200; those due to coral mining were between $175,500 and $902,500 and those due to logging sediment were $273,000. In contrast, the estimated sustainable annual coral reef direct and indirect economic benefits per 1 km^2 of typical healthy coral reef with tourism potential were between $31,900 and $113,000 (Table 8). These per unit area losses and gains were large and would certainly become even much more significant when the overall area of destroyed coral reefs in the country was considered in the computations.

Conclusion

Economics and environment are closely intertwined in the fishery sector. From the economic standpoint, the fishery sector boasts of huge potentials. Unfortunately, these potentials have been dissipated by years of mismanagement. Managing the environment is one way to recover potential losses in the fishery sector. It translates to better catches for poor fisherfolk and ultimately, greater contributions to the total economy.

References

ADB (Asian Development Bank). 2001. Key indicators 2001 of developing Asian and Pacific countries. Oxford University Press, UK. 498 p.

BFAR (Bureau of Fisheries and Aquatic Resources). 1997. 1997 annual survey of establishments: fishing. BFAR, Quezon City, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 1999. Philippine fisheries profile. BFAR, Quezon City, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 2001. Philippine fisheries profile. BFAR, Quezon City, Philippines.

CMC (Coastal Management Center). 2003. Philippine fishery industry sectors study. Draft final report. Technical Education and Skills Development Authority, Philippines.

CRMP (Coastal Resource Management Project). 1998. Results of the participatory coastal assessment in Olango Island, Cebu. CRMP, Cebu City, Philippines.

Dalzell, P., P. Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. BFAR Tech. Pap. Ser. 10(3), 23 p.

EMB (Environmental Management Bureau). 1996. Philippine environmental quality report. EMB, Quezon City, Philippines. 379 p.

FAO (Food and Agriculture Organization). 2002. Fishery statistics 2000. FAO, Rome, Italy.

Israel, D.C. and R.R. Roque. 1999. Toward the sustainable development of the fisheries sector: An analysis of the Philippine Fisheries Code and Agriculture and Fisheries Modernization Act. Discus. Pap. Ser. No. 99.01. Philippine Institute for Development Studies, Makati City, Philippines.

Katon, B.M., R.S. Pomeroy, M. Ring and L.R. Garces. 1998. Mangrove rehabilitation and coastal resource management: A case study of Cogtong Bay, Philippines. Naga 21(1): 46-52.

Librero, A.R., R.F. Catalla and R.M. Fabro. 1985. Socioeconomic conditions of small-scale fisheries and fish farmers in the Philippines, p. 36-45. *In* T. Panayotou (ed.) Small-scale fisheries in Asia: Socio-economic analysis and policy. International Development Research Centre, Ottawa, Canada.

Melana, D.M. and C.A. Courtney. 2000. Mangrove conservation and rehabilitation in the Philippines. Paper presented during the Second Session of the Japan International Cooperation Agency Third Country Training Programme on Responsible Aquaculture, 5 September-3 December 2000, Aquaculture Department, Southeast Asian Fisheries Development Center, Iloilo, Philippines.

NEDA (National Economic and Development Authority). 1998. The Philippine national development plan directions for the 21st century. NEDA, Makati City, Philippines.

NSCB (National Statistical Coordination Board). 1998. Philippine asset accounts: Forest, land/soil, fishery, mineral, and water resources. NSCB, Philippines. 228 p.

NSCB (National Statistical Coordination Board). 2002. Philippine statistical yearbook. NSCB, Philippines.

NSO (National Statistics Office). 2001. Family income and expenditure survey 2000. NSO, Philippines.

Padilla, J.E. and F. de Guzman. 1994. Fishery resources accounting in the Philippines: Applications to small pelagic fisheries. In Philippine Environmental and Natural Resources Accounting Project, Phase II. Quezon City, Philippines. 26 p.

PRIMEX. 1996. Fisheries sector development project, Philippines (ADB TA No. 2236-PHI). Phase I report. Vol. II. Fisheries Sector Program review. (Unpublished).

Silvestre, G.T. and D. Pauly. 1989. Estimates of yield and economic rent from Philippine demersal stocks (1946-1984) using vessel horsepower as an index of fishing effort. Univ. Philipp. Vis. Fish. J. 1(2): 2(1/2); 3(1/2): 11-24.

Smith, I.R. 1979. A research framework for traditional fisheries. ICLARM Stud. Rev. 2, 45 p.

Trinidad, A.C., R.S. Pomeroy, P.V. Cruz and M. Aguero. 1993. Bioeconomics of the Philippine small pelagics fishery. ICLARM Tech. Rep. No. 38, 74 p.

White, A.T. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines. 86 p.

Poverty Profile in Philippine Fisheries[1, 2]

RONET SANTOS
Sharing, Promotion and Awareness of Regional Knowledge Programme
Voluntary Service Overseas
20 South Lawin cor. Bacolod Rd.
Philam Homes, Quezon City
Philippines

Introduction

There has been limited concern with targeting poor people in fishery management in the past. This is partly due to assumptions that downstream benefits in improvements in fishery production would lead to livelihood benefits for the poor (Friend and Funge-Smith 2002), when in fact usually the nonpoor groups are the ones benefiting. The nonpoor's economic position is further strengthened, leading to further differentiation and marginalization that feed social conflict. On the other hand, specifically targeting poor fishers in development interventions has also led to exacerbating social divisions - which just shows how poverty is not well understood and difficult to address.

Fishery management has focused traditionally on biophysical aspects – i.e., corals, other benthos, fishes, and the physics and chemistry of water. Today fisheries are coming under increasing pressure from other human activities. Fishery researchers, managers and policymakers recognize the importance of understanding not only the biophysical conditions that determine system structure and processes, but also the social and economic conditions, contexts and motivations that are associated with the use of fishery resources (Bunce *et al.* 2000).


R. Santos

Typical subsistence fisher (Tubigon, Bohol), a sector which has long been overlooked in fisheries management in the country.

Poverty[3] is a social and economic condition and its links with the biophysical condition of fisheries are not well understood. Majority of the estimated 800,000 persons (DA-BFAR 2000) directly dependent on fisheries are perceived to be poor. The Fisheries Sector Program (FSP) noted that in 1996, 80% of fisher households lived below the poverty threshold at that time (DENR *et al.* 2001)[4]. Understanding poverty in fisheries therefore is crucial in the success of any fishery management program whose objectives include maintenance of the resource base and sustaining the well-being of the people who use the resource. The

---

[1] This paper can be cited as follows: SANTOS, R. 2003. Poverty profile in Philippine fisheries, p. 138-143. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] This article is based on a lengthier paper commissioned by the Support to Regional Aquatic Resource Management (STREAM), a five-year learning and communication initiative based in Bangkok, Thailand, and founded by the Network of Agriculture Centres in Asia Pacific, Department for International Development, Food and Agriculture Organization and Voluntary Service Overseas.

[3] There is no globally agreed definition of poverty; there are only dominant meanings and evolving poverty measures. The World Bank defines poverty as "pronounced deprivation in well-being." Deprivation, in the World Bank definition, means to be hungry, to lack shelter and clothing, to be sick and not cared for, to be illiterate, to be vulnerable to adverse events, to be excluded in institutions of state and society.

[4] The poverty threshold for 1996 is the 1994 figure, P8,885, as there was no survey done in 1996. Poverty reports are published every three years, the last three were done in 1994, 1997 and 2000. How FSP reached this figure is not clear.

key challenges for institutions and agencies involved in fisheries management are not just to utilize existing and emerging technical information more effectively, but also: (1) how to better understand poor fishers' livelihoods, and (2) how to enable their perspectives to exert greater influence over policies and processes that relate to fisheries management which have an impact on their lives (STREAM 2001).

Poverty Measures

Poverty measures reflect how poverty is defined. There are two approaches used in measuring poverty in the Philippines: income-based and outcome-based (Callanta 1988; Balisacan and Fujisaki 1999; Monsod and Monsod 1999). Globally, the trend is towards the use of outcome-based approaches. Income-based approaches use a "poverty line"[5] usually defined in terms of having enough income to spend on a specified minimum amount of food and nonfood basic items of expenditure. Poverty incidence figures are an example of this. Outcome-based measures focus on the absence or lack of some minimum acceptable level of basic needs (which go beyond lack of income) or on the lack of some basic capabilities for people to function or survive. The human development index (HDI)[6] is an example of an outcome-based measure; the minimum basic needs (MBN) measure (a percentage figure) is another.

Poverty in Philippine Fisheries

Poverty monitoring

National level. Poverty monitoring in the Philippines has traditionally been done at the national level[7], until 1997 when the Minimum Basic Needs-Community-based Information System (MBN-CBIS) was introduced (ESCAP 1998). There are three ways in which poverty is monitored at the national level:

1. through the triennial (latest was in 2000) family income and expenditure survey (FIES) done by the National Statistics Office (NSO) with about 41,000 sample families which yields poverty and subsistence threshold figures and poverty incidence figures at the provincial, regional and national levels;
2. through the triennial (latest was in 2000) computation of HDI by the National Statistical Coordination Board (NSCB)[8] based on the income figures generated through the FIES survey, the literacy figures of the Department of Education and life expectancy figures of NSO; HDI index figures are available at the provincial and national levels (Figure 1); and
3. through the annual[9] poverty indicator survey (APIS) by NSO which uses both income and outcome-based measures using about 41,000 sample families which yields national[10], regional and provincial percentage figures for each of the current 13 (it used to be 33) MBN indicators[11].

It is therefore not possible to get poverty figures for specific sectors such as fisheries at the national level. There seems to be no point in doing so, as the costs seem to outweigh the benefits. Poverty figures, however, are helpful in targeting specific provinces where poverty incidence is high or where the province ranked low in the HDI or MBN rankings.

Poverty incidence in the Philippines was 34% in 2000[12]. The HDI figure of the Philippines for the same year was 0.656 and the country was ranked 77 out of more than 150 countries, which makes it a middle-income country. HDI and poverty incidence figures and APIS results are available at the NSCB and NSO websites (www.nscb.gov.ph and www.census.gov.ph).

[5] The poverty threshold for the year 2000 is P11,605 (NSCB). The World Bank poverty threshold, which is used internationally, is US$1 a day.
[6] The HDI is composed of three indicators: income, education and life expectancy.
[7] Based on communications with Jessa Encarnacion, information officer at NSCB; Paulo Oblea, statistician at NSO; and Jay de Quiros and Fe Cabral, development management specialists at the National Anti-Poverty Commission (NAPC).
[8] The first HDI computation was done in 1994 and had breakdowns up to the provincial level.
[9] The frequency of doing APIS is annual except on years when there is an FIES. There was one done in 1998 and another one in 1999; the next report will be for 2002.
[10] They start with the national and regional figures before coming up with the provincial figures.
[11] The MBN indicators currently consist of 13 indicators divided into 3 dimensions (survival, security and enabling dimensions). Example of an indicator under each dimension: survival - % of families with access to safe drinking water; security - % of families with lands other than residence; enabling - % of families with children in elementary school to families with children 6 to 12 years old.
[12] The poverty incidence level in the Philippines has not dropped significantly since 1985 compared to its Asian neighbors, Indonesia and Thailand.

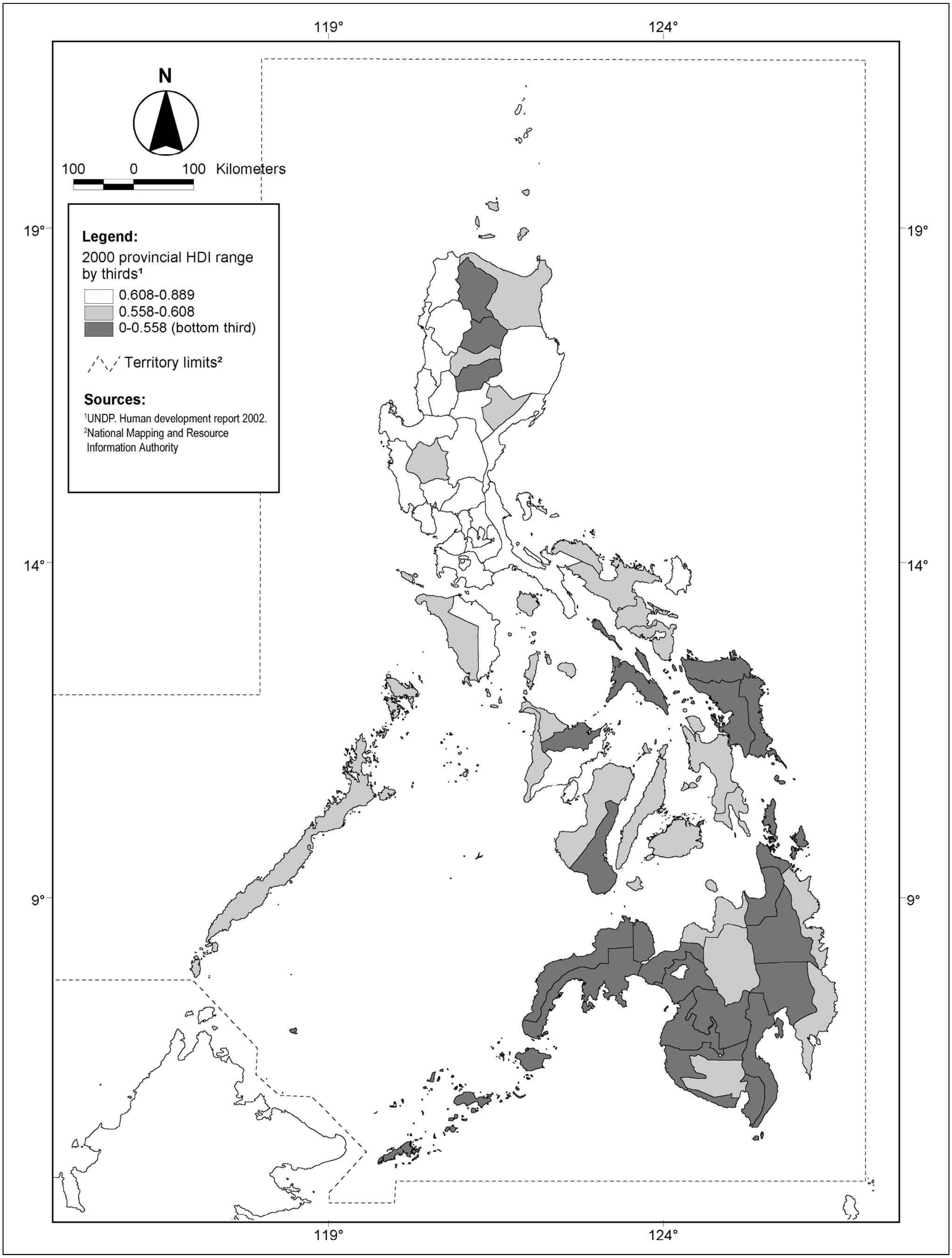


Figure 1. Year 2000 provincial HDI presented as ranges by thirds.

Overall fisheries-related production has been increasing and for the last 10 years hovered around 2.7 million t from 0.5 million t in 1970, but catch per unit effort (CPUE) for small pelagic fisheries has decreased from about 2.8 t/hp in 1948 to about 0.2 t/hp in 1996 (DENR *et al.* 2001). Such decline in CPUE must be linked to poverty levels in fisheries.

Local level. Poverty monitoring at the local level began with the introduction of MBN-CBIS in 1997. The MBN-CBIS was first installed in all barangays of the 960 fifth and sixth class municipalities[13] nationwide in cooperation with the Social Reform Council, Presidential Commission to Fight Poverty (which became NAPC in 1998), Department of the Interior and Local Government (DILG), and Department of Social Welfare and Development. Unlike APIS, which also uses the MBN framework, the MBN-CBIS is based on total enumeration (100% sampling), which makes it more reliable. The APIS and MBN, however, are not comparable (meaning MBN-CBIS figures cannot be aggregated beyond the municipal level to yield provincial and national figures) because municipalities are permitted to use other indicators in addition to the core 13 that is used in the APIS. The results of the MBN-CBIS are therefore a more reliable guide in local policymaking, budgeting and overall implementation of development programs at the local level. A year after it was introduced, enumeration has been done in more than 60% of the barangays in the first 960 municipalities that were targeted.

Causes of poverty in the aquatic resources sector

A cause and effect diagram done by the International Institute for Rural Reconstruction in 1998 shows that "low fish catch" is the immediate reason for "declining incomes" and "decreasing quality of life," which are aspects of poverty (DENR *et al.* 2001). The underlying reasons mentioned were: (1) illegal fishing in municipal waters, (2) loss of fish nursery and (3) overexploitation. These in turn were caused by: (1) financing of illegal fishing activities and intrusion of commercial fishing in municipal waters, (2) land reclamation of destroyed mangroves and (3) increasing population pressure. Deeper reasons cited were: (1) de facto open access regimes and (2) an overall lack of integrated planning and management of coastal resources (DENR *et al.* 2001).

Simple cause and effect diagrams (or sometimes called problem trees or causal maps) are a common way of exploring and understanding the causes of poverty. Another way is the livelihoods framework of the Department for International Development (DfID) that looks at resources (which it calls assets) that people have, the vulnerability context, and the context of policies, institutions and processes (see www.livelihoods.org). What the above shows is that the causes are complex, which means the solutions are also necessarily complex.

How the problem of poverty in fisheries has been addressed

The Philippine Medium-term Development Plan (covering 1999-2004) calls for reducing overall income poverty from 32% in 1997 to about 26% in 2004. The NAPC calls for reducing poverty to 20% by 2004 (UNDP 2000). The government, through NAPC, has a five-point anti-poverty agenda for small fishers (see Table 1). The plan emphasizes resource management over poverty alleviation as can be seen from its national targets on local management of coastal and marine resources for 1999-2004 (Table 2).

Other poverty-focused interventions in fisheries

The Fisheries Resource Management Project (FRMP) is the only project in the Philippines that has an expressed poverty focus (in the broadest sense of the term). FRMP responds to issues of fisheries resource depletion and persistent poverty. The three major components of this program are: (1) fisheries resource management, (2) income diversification and (3) capacity-building.

Another major project is the Coastal Resource Management Project which is implemented by the Department of Environment and Natural Resources, Department of Agriculture-Bureau of Fisheries and Aquatic Resources and DILG and supported by the United States Agency for International Development. Its strategic aim is to assist LGUs to institutionalize CRM planning and implementation and influence national policy on CRM. The poverty alleviation objective seems to be implicit in this strategic aim.

There are more than a hundred nongovernment organizations involved in varying degrees of poverty-

[13] This means aggregation can be done only up to the municipal level.

Table 1. Anti-poverty agenda of NAPC for small fishers, 2001 and beyond.

Sectoral Agenda	Core Strategies
Asset reforms	• Priority use of municipal waters by municipal and small fishers • Preferential rights and priority use of small fishers cooperatives and organizations on the following: expired, abandoned, underutilized fishponds and aquaculture areas and devices
Human development services	• Provision of adequate settlement and habitat areas for fishers through strict implementation of Republic Act 8550, Section 108 (settlement of fisher communities) • Provision for scholarship and training programs to improve skills of fisher communities and their organizations
Employment and livelihood services	• Implementation of Fisheries Administrative Order 195 on banning importation of fish (chilled/ frozen) for wet markets • Provision of production and income to support fisher beneficiaries through cold storage infrastructure, post-harvest facilities and farm-to-market roads • Support mechanisms for communities affected by El Niño • Revision of Department of Agriculture's (DA) credit policy on availment
Participation	• Participation of fishers in law enforcement through the establishment of provincial legal assistance centers • Support for Fisheries and Aquatic Resource Management Councils (FARMCs) at the national and local levels by allocating P100 million ($2 million) in DA's 2002 budget • Release of allocated budget for training under the fisheries programs to support capability- building of fishers
Security and social protection	• Stop military operations in coastal areas by instituting consultation process in the local area

Table 2. Strategic objectives for local management of coastal and marine resources, 1999-2004 (DENR *et al.* 2001).

Increased coastal management adopted by 250 local government units (LGUs) (out of more than 800 coastal LGUs) covering 6,000 km of coastline for the management of municipal waters

- 2,000 ha of mangrove areas and 25,000 ha of coral reefs rehabilitated under effective LGU management
- 250 LGUs with active CRM interventions develop site-specific CRM plans and corresponding investment portfolio
- 250 LGUs with municipal FARMCs established and strengthened

focused fishery management activities. Most of these are involved in organizing small fishers into people's organizations, helping these to establish MPAs, assisting them with supplemental and alternative livelihood projects and in advocating for pro-poor policies in fisheries. The private sector remains largely untapped in poverty-focused programs.

Integrating poverty-focused processes in fishery management programs

Current literature suggests that addressing poverty in fisheries does not necessarily mean giving exclusive assistance to fishers who are perceived to be poor (World Bank 2000; STREAM 2001; Friend and Funge-Smith 2002; DfID[14]). A better understanding of the wider context (resources available to people, policies, institutions, processes and vulnerability) that constrains fishers from taking full advantage of the opportunities available to them to carry out sustainable livelihood options is required. The NAPC's anti-poverty overall strategy reflects the above trend, although it still leans towards exclusively targeting perceived poor fishers by basically increasing their assets[15]. The Medium-term Development Plan targets favor the strengthening of the capacity of mandated institutions to carry out CRM programs.

[14] See www.livelihoods.org.

[15] Assets here refer to human, financial, social, physical and natural assets. Human development services are aimed at increasing human assets, while employment and livelihood services, at increasing financial asset, and participation, at increasing social capital.

The presence of poverty monitoring systems (which can have general and sector-specific, such as fisheries, components) indicates the existence of clear anti-poverty agenda within LGUs, and these systems also reflect how poverty is understood, which in turn gives a picture of how it will be addressed. Current poverty monitoring systems in the country at the national level are useful in national policymaking and in targeting specific areas for development intervention. But these have very little relevance to municipal governments - to whom a significant amount of responsibility for implementing fisheries management has been devolved - in better understanding poverty and addressing it at the local level. These municipal governments may find the MBN framework in poverty monitoring - which they can adjust to suit their specific needs based on local understandings of poverty - more relevant for their purposes.

References

Balisacan, A. and S. Fujisaki, Editors. 1999. Causes of poverty: Myths, facts and policies, a Philippine study. University of the Philippines Press, Quezon City, Philippines.

Bunce, L., P. Townsley, R. Pomeroy and R. Pollnac. 2000. Socio-economic manual for coral reef assessment. Australian Institute of Marine Science, Townsville, Australia.

Callanta, R. 1988. Poverty, the Philippine scenario. Bookmark, Quezon City, Philippines.

DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). 2000. The 1999 Philippine fisheries profile. DA-BFAR, Quezon City, Philippines.

DENR/DA-BFAR/DILG (Department of Environment and Natural Resources, Department of Agriculture-Bureau of Fisheries and Aquatic Resources and Department of the Interior and Local Government). 2001. Philippine coastal management guidebooks. Vols. 1-8. Coastal Resource Management Project of DENR, Cebu City, Philippines.

ESCAP (Economic and Social Commission for Asia and the Pacific). 1998. Review of statistical activities in the region. Eleventh Session of the ESCAP Committee on Statistics, 24-26 November 1998, Bangkok, Thailand.

Friend, R. and S. Funge-Smith. 2002. Focusing small-scale aquaculture and aquatic resource management on poverty alleviation. STREAM, Food and Agriculture Organization and Network of Aquaculture Centres in Asia Pacific.

Monsod, S. and T. Monsod. 1999. International and intranational comparisons of Philippine poverty. *In* A. Balisacan and S. Fujisaki (eds.) Causes of poverty: Myths, facts and policies, a Philippine study. University of the Philippines Press, Quezon City, Philippines.

STREAM (Support to Regional Aquatic Resource Management). 2001. Support to regional aquatic resource management: Program pack. Network of Aquaculture Centres in Asia Pacific, Food and Agriculture Organization and Voluntary Services Overseas, Bangkok, Thailand.

UNDP (United Nations Development Programme). 2000. Overcoming human poverty: UNDP Poverty report 2000. UNDP, New York, USA.

UNDP (United Nations Development Programme). 2002. Human development report. Deepening democracy in a fragmented world. Oxford University Press, New York, USA.

World Bank. 2000. World development report 2000/2001: Attacking poverty. Oxford University Press, Oxford, UK.

Women in Fisheries in the Philippines[1]

IDA M. SIASON
University of the Philippines-Visayas (UPV)
Miag-ao, Iloilo City
Philippines

Overview of the Fisheries Sector

The Philippines is an archipelagic country of 7,100 islands and is endowed with vast aquatic resources. It is a world-significant fish producer, ranking eleventh among the 80 fish-producing countries of the world. The fishing industry contributed 3.8% to total gross domestic product (GDP) and 18.6% to gross value added (GVA) in the agriculture industry group, valued at P34 billion (constant prices).

Approximately 990,872 people are employed in the fisheries sector, about 5% of the country's labor force. Of these, 68% are employed by municipal fishing, 26% by aquaculture, and 6% by commercial fisheries. The 1995 census of population reports that 91.7% of those employed in fisheries are male and 8.2% are female, indicating that fisheries is a male-dominated field. The aggregate employment proportions by sex in the rural population are 70% male and 30% female. As demonstrated in a later section and revealed by various studies, the participation rate of women in the fishing sector is underestimated.

Social, Demographic and Psychological Characteristics of Women in Fishing Households

Several studies on gender dimensions in fisheries (de Castro *et al.* 1986; Illo and Polo 1990; Israel-Sobritchea 1994; Hondrade and Rodriguez 1994; Ardales 1997; Villacorta 1998) show that the majority of female respondents have completed an average of 4-6 years or less of education. Their level of education is not very different from that of men. While this figure is similar to rural women in general, it is lower than the average among women in urban areas (6.9 years).

Accurate income data are difficult to obtain, although in the above studies when household income is reported, the range has been from P13,740 ($327) to P37,000 ($880) in 1991. Data from the 12 bays in the Philippines (PRIMEX-ANZDEC 1996) reported an average annual income of P25,426 ($605) in 1992. Therefore, despite the importance of the fisheries sector to the national economy, the majority of those who engage in it as a livelihood earn average incomes way below the poverty threshold.

The following characteristics of the communities reported in the 12 bay studies (PRIMEX-ANZDEC 1996) reveal the living conditions of fisher households:

- Average age of household head is 41 years; of spouse, 37 years.
- Average family size is 5.1 (although the range reported in the studies cited above is 4-9 members).
- Some 82% own their houses.
- Some 44% of houses are made of nipa and bamboo, and 34% of nipa and wood.
- Some 40% own the lot where their house stands.
- Some 51% have toilet facilities.
- Some 25% of households are members of community organizations.
- Some 20% have used loans, 83% of which came from informal sources.

In the five study sites, both women and men are members of the local fisherfolk association. The other women are mainly active in homemaker types of organizations such as those for health and social welfare. However, they usually represent their husbands in assemblies of fisher or farmer organizations, which are male-dominated.

---

[1] This paper is an edited reprint of the full article which originally appeared as: SIASON, I.M. 2002. Women in fisheries in the Philippines, p. 69-77. *In* M.J. Williams, N.H. Chao, P.S. Choo, K. Matics, M.C. Nandeesha, M. Shariff, I. Siason, E. Tech and J.M.C. Wong (eds.) Global Symposium on Women in Fisheries: Sixth Asian Fisheries Forum, 29 November 2001, Kaohsiung, Taiwan. 209 p.

This paper can be cited as above or as follows: SIASON, I.M. 2004. Women in fisheries in the Philippines, p. 144-149. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

The attitudes of women regarding their roles (Hondrade and Rodriguez 1994) project the gender division of labor prevailing in most of Philippine society. The men support the family financially and handle the heavy workload. Women attend to all the problems and needs of the family and household, safekeep and allocate the husband's meager earnings, and manage the household budget. The women view themselves more as supporters than leaders, and are proud of the success of those they have assisted. They have a self-sacrificing attitude in pursuing their home obligations.

These beliefs about roles are manifested in the activities performed daily, which include child bearing and rearing, dishwashing, laundering, house cleaning, vegetable gardening, fuel and water gathering. Typical also in rural households is rearing pigs or poultry in backyards, which women do to augment meager incomes and to provide for family food needs.

Women's involvement in community decision-making and leadership is limited. Some serve as captains of barangay (smallest political unit in the Philippines' governance system). More often, however, the women assume lesser positions such as secretary, treasurer or "muse" of organizations, and become top officers only in all-women associations (Hondrade and Rodriguez 1994). Women believe that men are more decisive than they are. Such a perception reinforces the male-dominated leadership and decisionmaking structures and processes. However, more women than men regularly attend community meetings (Hondrade and Rodriguez 1994; Abregana *et al.* 1996). Without realizing it, women may actually have an active influence in decisionmaking.

Role of Women in Fisheries

Fishing is an occupation dominated by men because of the image that only they go to sea in their fishing boats. Women are prohibited to go mainly due to the need for them to remain within the premises of the household to do their designated responsibilities. Thus, they have little direct involvement in fish capture. However, they are involved in shell and fry gathering/gleaning, spear fishing in rivers, reef fishing using scoop nets, traps and fish baskets, all of which tend to be nearshore activities (Lachapelle 1997; Villacorta 1998). These activities nevertheless contribute to household income or provide food for the table. Though less common, Muslim women in fishing villages in Davao (southern Philippines) join their husbands in fishing expeditions (Israel 1993), in hauling nets and lines (de Castro *et al.* 1986; Villacorta 1998) and in installing and maintaining stationary gear (Lopez-Rodriguez 1996a).

Fishing as an occupation is more than just fish production. The participation of women before and after fish capture has been given little importance. However, these pre and post-production activities are significant in terms of their economic and social value. These include net mending, sorting fish upon landing, fish vending, trading and market retailing, and processing and preservation (salting or drying). Men are involved in marketing mainly when dealing with intermediaries and the fish caught is of high commercial value (tuna, abalone). Otherwise, women handle the small-scale marketing that involves inexpensive fish varieties. Fish processing and preservation is mainly the arena of women because it is associated with food preparation. Women engaged in post-harvest fishing activities constitute 40% of such workers and substantially increase the total income of their households (Legaspi 1995). The social value of such activities lie in the support wives give to their fisher husbands, and in reinforcement of relationships within the community, such as in dealing with *suki* or favored buyer.

As regards seeking credit, while banks and other formal credit institutions recognize the men as borrowers, however, the women transact loans from relatives and neighbors through informal community links.

Women's participation in community-based coastal resources management

Due to the steady decline in marine fish production and the alarming degradation of the marine environment, there has been a marked shift towards developing strategies in favor of managing and sustaining coastal resources through the involvement of different stakeholders, including women. A perusal of the reports on experiences in community-based coastal resources management (CBCRM) reveal that the gender issue is not reported as a distinct component, except in Lopez-Rodriguez' article (1996b), which focuses on women's issues and gender roles in the project site in Batan, Panay Island. In this project, the men, women and children were trained in tilapia cage culture - feeding, sampling, cage cleaning and harvesting. The women were assigned the tasks of financial recording and record-keeping. Among the significant outcomes of the experience, in addition to the generation of additional income, are: reinforcement of women's entrepreneurship in fish vending; fostering of unity among cooperative members; training in leadership; and appreciation and recognition by men of women as partners at work and at home. The sensitivity to gender issues, which was part of the training in community organization, has also resulted in men increasingly assuming some share of household chores.

The other reports make no distinction of who-does-what in interventions in CBCRM process. At most, they mention that women's groups are among those that have been established as part of the essential community organization component. Whether this neglect is only in the reporting may not be a trivial matter. Nevertheless, the recommendations should have reflected a specific concern for women's issues.

Interviews with a few NGO personnel reveal that women's issues are given some emphasis in their respective CBCRM programs. However, their experiences are not published. This deprives the public of needed information that would have been useful in fostering the integration of women in fisheries development. The interviews also reveal that women, more so than men, serve on the front line in enforcing fisheries regulations and confronting violators regarding, for example, the use of illegal gear, use of dynamite in fishing, etc. The women are seen as better negotiators and as more level-headed in handling conflicts than men.

Nonfishing-related activities

Coastal communities engage in a combination of fishing and farming as a way of coping with the seasonal nature of these occupations. Table 1 drawn from Lopez-Rodriguez (1996b) illustrates the gender-desegregated profile of activities in fishing communities. The profile shows that women play multiple roles beyond the child bearing and community maintenance ones with which they are mainly associated.

It is common for women to engage in work outside the home, such as sewing, weaving, running *sarisari* (variety) stores, selling beauty products and food peddling. Women have also been implementers and beneficiaries of livelihood projects offered by both government and nongovernment agencies.

Women are easily recruited as community volunteers and development workers, especially in domains that seem to be an extension of their traditional roles. These are time-consuming, unpaid jobs such as day-care workers, nutrition scholars, barangay health workers and church volunteers.

Problems/Issues Involving Women's Sectoral Participation

Post-capture activities, such as fish marketing and processing which women have assumed, will require capitalization that poor fishing households cannot afford. While credit programs for artisanal fishers exist, these are generally intended for production activities, such as for gear improvement, construction of artificial reefs, fry gathering, crab-fattening, etc. Such loans are made available primarily through the male-dominated fishers' cooperatives. Thus, there is no credit facility primarily intended to respond to the needs of women who sell fish or process the catch. Such credit may be used to buy the catch of other fishers for bigger processing operations.

Technical assistance, training and extension have been designed to target only the male fisher, not mindful of women who are just as active in many spheres of fish production. Women do not learn new technology and are not consulted on technical problems in production activities. Usually their source of knowledge of such things is through their fisher husbands, who learn directly from the fisheries technicians.

Women's participation in the reduction of post-harvest losses in fisheries and improvement of fish processing technology is crucial. They should be a major target group in training and support with regard to these.

Fish marketing and trading activities are limited as women are less mobile and expected to operate close to the domestic front. Thus, information on prices and market trends is not available as this is usually available only in the central fish markets.

Low educational attainment and sociocultural constraints hamper the full participation of women in development activities of the sector. Their ability to use and access available information is affected by their level of literacy. Their belief in their own lack of competence and ability, vis-à-vis their male counterparts affects their self-confidence in independently pursuing projects.

Women's participation in income-generating activities and other development tasks, such as attendance at meetings and training courses, is observed to be short-lived, especially when monitoring by granting agencies ceases. One reason for this is the time required from women, considering their multiple burdens of regular domestic and productive activities. Unless provisions are made to deal with other commitments, full involvement in development programs will not be sustained.

Women's work is most disadvantaged and marginalized when coastal and marine resources are degraded and depleted. When reefs and mangrove areas are destroyed, women fishers who use simple gears are relegated to shell gathering or to vending the produce of nearby fishponds (Lopez-Rodriguez,

Table 1. Activity profile: Camaligan, Lalab and Magpag-ong, Batan municipality, Aklan, 1993 (Lopez-Rodriguez 1996b).

Activity	Adult Male	Young Male	Adult Female	Young Female
A. Household				
Cooking			***	***
Washing dishes			***	***
House cleaning			***	***
Fuel gathering		***	***	***
Water gathering	***	***	***	***
B. Aquaculture production				
1. Pond preparation				
Cleaning of pond	***			
Drainage/drying	***			
Fertilizing	***			
Filling of pond	***			
2. Releasing of fingerlings	***			
3. Harvesting	***	***	***	***
C. Marine fisheries production				
Letting down the nets	***	***		
Raising of nets	***	***		
Mending of nets	***		***	
Processing of catch	***		***	
Selling of catch			***	
Shell gathering		***	***	***
D. Community activities				
Local government	***			
Church activities	***	***	***	***
Social dances	***	***		***
Market days	***		***	
Cockfights	***			
Athletics	***	***		***
E. Farming				
1. Land preparation				
Plowing	***	***		
Harrowing	***	***		
Dike repair	***	***		
2. Planting				
Seedling preparation	***	***	***	***
Transplanting	***	***	***	***
3. Maintenance				
Fertilizing	***			
Pesticide application	***			
Herbicide application	***			
Weeding	***	***	***	***
4. Harvesting				
Cutting	***	***		
Threshing	***	***	***	***
Drying	***		***	***
5. Poultry/livestock raising			***	***
6. Home gardening			***	***
F. Copra gathering				
Gathering of coconuts	***	***		
Halving of nuts	***	***		
Preliminary drying	***	***		***
Extraction of meat	***	***		***
Drying of meat	***	***		***
G. Nipa thatching				
Cutting of nipa stalks	***			
Slicing leaves from stalks	***	***		
Bundling	***	***	***	

Table 1 (cont.)

Table 1 (cont.)

Activity	Adult Male	Young Male	Adult Female	Young Female
G. Nipa thatching				
Transporting	***			
Pipis sewing			***	
Selling	***		***	
H. *Daet* weaving				
Acquisition of buntal			***	
Fiber extraction	***	***	***	***
Pagkiskis			***	***
Combing			***	***
Washing			***	***
Boiling			***	***
Solar drying			***	***
Connecting fibers			***	***
Sabungon			***	***
Subponon			***	***
Eikison			***	***
Weaving			***	***

1996a). Younger women leave the fishing villages to seek employment as either domestics or factory workers. The men, on the other hand, could acquire more powerful vessels to take them further to sea. These concerns highlight the need for the deliberate inclusion of women in CBCRM, as they are significant stakeholders.

There is no research program that systematically tackles gender issues, women's participation and integration in fisheries development. Databases which are sex-disaggregated and which may be used in more effective planning and implementation in this sector hardly exist.

Recommendations

Extension programs intended for fisheries should incorporate gender concerns into the planning and design of the activities. This may manifest itself in interventions to assist the traditional roles of men and women in society, and at the same time open up avenues for new or expanded roles and responsibilities for women.

In the same vein, technical assistance for improved fish processing technology, a major domain of fishers' wives, should be instituted. This may go beyond the traditional sun drying and salting processes, and into newer technologies, but with adequate support in equipment and related facilities.

Training for entrepreneurship should be another priority. Women are already engaged in small trading enterprises. They would benefit from inputs on risk-taking, better business practices, and financial management.

An improved market information system will benefit fishers' decisions on fish prices and make them less dependent on prices offered by intermediaries. The aim is to increase the profit margins of fishers' household.

While interventions intended to benefit women are desirable, provisions to provide them with some time to attend to the development activities should be included; for example, day-care services, child-minding centers and possible pooling of cooking responsibilities.

There should be stronger advocacy and actual conduct of gender sensitivity training for both men and women in the communities. This will aim to sensitize the community to the issues brought on by the culturally constructed gender division of labor, the relative valuing of men's and women's works, gender stereotypes, and to lead it toward gender-fair and gender-sensitive interactions. This can likewise surface issues on domestic violence and reproductive health and rights (Lopez-Rodriguez 1996a). If these issues are adequately addressed, women's status and participation in the fisheries sector will improve.

Research programs that will systematically examine women's participation and impact in CRM should be pursued. Action research which tests the workability of new roles and responsibilities for women (e.g., as information disseminators or as recipients of formal credit for entrepreneurial activities) should be carried out to identify factors influencing the effectiveness of the role changes.

Interventions to strengthen and formalize women's role in CBCRM and other community development initiatives should be instituted. Gender perspectives in environmental issues and resource management should be incorporated into training programs and management structures.

References

Abregana, B., P.G. Barber, M. Maxino, P. Saunders and D. VanderZwaag. 1996. Legal challenge for local management of marine resources: A Philippine case study. ERMP Rep. (32):1-112.

Ardales, V. 1997. Gender roles in sustainable agricultural and aquacultural productivity: The case of Western Visayas. Center for Research and Development, University of Iloilo, Iloilo, Philippines.

De Castro, L., C. Formacion and L. Zapanta. 1986. Role of rural women in the development of fisheries in Panay: Focus on the socio-cultural and economic variables. University of the Philippines-Visayas, Iloilo, Philippines.

Hondrade, S. and L. Rodriguez 1994. Food system in Batan. Food Systems Development Project, University of the Philippines-Visayas, Iloilo, Philippines.

Illo, J.I. and J. Polo. 1990. Fishers, traders, farmers, wives: The life stories of ten women in a fishing village. Institute of Philippine Culture, Ateneo de Manila University, Quezon City, Philippines.

Israel, L. 1993. Women in the fisheries sector: A review of the literature. Lundayan 2(2): 2-3. Tambuyog Development Centre, Quezon City, Philippines.

Israel-Sobritchea, C. 1994. Gender roles and economic change in a fishing community in Central Visayas, p. 279-304. *In* I. Ushijima and C. Zayas (eds.) Fishers of the Visayas. Vis. Marit. Anthropol. Stud. I: 1991-1993. CSSP Publications, University of the Philippines, Quezon City, Philippines.

Lachapelle, G. 1997. Gendered livelihoods and development in a coastal community in the Visayas region of the Philippines. Department of Geography, Dalhousie University, Canada.

Legaspi, A. 1995. Role of women in fisheries development in the Philippines, Annex 23. Final report of the Regional Workshop on the Role of Women in Fisheries Development, GOP-UNDP SU/TCDC-TCCP.

Lopez-Rodriguez, L. 1996a. Gender relations in community-based coastal resource management, p. 78-83. *In* C. Foltz, R.S. Pomeroy and C.V. Barber (eds.) Proceedings of the Visayas-wide Conference on Community-based Coastal Resources Management and Fisheries Co-Management. Fisheries Co-Management Res. Proj. Work. Pap. No. 4. ICLARM, Makati City, Philippines.

Lopez-Rodriguez, L. 1996b. The fishers of Talangban: Women's roles and gender issues in community-based coastal resources management. *In* E.M. Ferrer, L. de la Cruz and M.A. Domingo (eds.) Seeds of hope. College of Social Work and Community Development, University of the Philippines, Quezon City, Philippines.

PRIMEX-ANZDEC. 1996. Fisheries Sector Development Project. ADB-TA 2236-PHI Draft Final Report. Fisheries Sector Program, Department of Agriculture, Quezon City, Philippines.

Villacorta, L. 1998. Various case studies. *In* A sourcebook of gender cases in agriculture, forestry and fisheries. PCAMRD-DOST, Laguna, Philippines.

Management of Tropical Coastal Fisheries in Asia: An Overview of Key Challenges and Opportunities[1]

GERONIMO SILVESTRE[2]
International Center for Living Aquatic Resources Management
MCPO Box 2631, Makati City 0718
Philippines

DANIEL PAULY[3]
International Center for Living Aquatic Resources Management
MCPO Box 2631, Makati City 0718
Philippines

Abstract

Coastal fisheries are an important component of the fisheries sector and rural economy of tropical developing countries in Asia – generating food, employment and foreign exchange. In 1994, marine landings of these countries were about 13.3 million t (roughly 16% of world marine landings), most originating from coastal areas. The coastal fishery resources consist dominantly of species with relatively high growth, natural mortality and turnover rates; and exhibit maximum abundance in shallow depths (less than 50 m). Fishers use a multiplicity of gears, with heavy concentration in nearshore areas where abundance, catch rates and shrimp availability are highest. The management of these coastal fisheries attempts to promote three main objectives: (1) productivity/efficiency, (2) distributional equity and (3) environmental integrity. Efficient institutional/administrative arrangements are sought to attain these objectives and to maintain a balance among them.

Coastal fisheries operate in a spectrum ranging from light fishing, essentially single sector (i.e., fisheries) situations to intense fishing and multisector use of the coastal area (and its adjacent terrestrial and marine zones). Issues impacting coastal fisheries multiply through this range, requiring increasingly comprehensive and integrated analytic frames and scope of action to sustain fisheries benefits. The key issues impacting coastal fisheries in the region include: (1) overfishing, (2) inappropriate exploitation patterns, (3) post-harvest losses, (4) conflicts between large and small-scale fisheries, (5) habitat degradation, (6) inadequacy of management information and research and (7) institutional weaknesses and constraints. Appropriate management strategies and actions on a broad front are necessary, and success is largely premised on institutional capabilities and resources mobilization. Moreover, the ultimate mitigation of these factors rests on effectively addressing poverty and promoting overall economic development.

---

[1] This paper is a reprint of the full article which originally appeared as: SILVESTRE, G. and D. PAULY. 1997. Management of tropical coastal fisheries in Asia: An overview of key challenges and opportunities, p. 8-25. *In* G. Silvestre and D. Pauly (eds.) Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

This paper can be cited as above or as follows: SILVESTRE, G. and D. PAULY. 2004. Management of tropical coastal fisheries in Asia: An overview of key challenges and opportunities, p. 150-167. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p. (ICLARM Contribution No. 1379).

[2] Current address is: Tetra Tech EM, Inc., Coastal Resource Management Project, 5th Floor, CIFC Towers, North Reclamation Area, Cebu City 6000, Philippines.

[3] Current address is: Fisheries Centre, University of British Columbia, 2204 Main Mall, Vancouver, BC, Canada.

Introduction

Coastal fisheries are important components of the fisheries sector and rural economy of tropical developing countries in Asia. These fisheries provide food and employment to a significant portion of the population, as well as valuable foreign exchange to the economy (Hotta 1996). In 1994, marine landings of these developing countries were about 13.3 million t (i.e., 16% of world marine landings and 12% of world fisheries production). Roughly 8 million fishers were involved in marine fisheries and aggregate fishery exports were about $9 billion per year. Most of the marine landings originated from fishing operations in coastal shelves (between the shoreline and 200 m depth) especially on their shallower parts (from 0 to 50 m). However, these fisheries are adversely affected by a number of problems and constraints, with serious consequences for the income of fishers, the supply of fish to consumers and poverty in rural communities.

This paper attempts to provide an overview of the main issues confronting coastal fisheries in tropical developing Asian countries as well as the corresponding management directions to help resolve or mitigate them. Numerous works provide detailed reviews of the overall situation through time and represent a substantive background and source of materials for this synopsis. Among others, the work of Aoyama (1973), Shindo (1973), Marr (1976, 1981) and Pauly (1979) and the contributions in Tiews (1973), Pauly and Murphy (1982), and Pauly and Martosubroto (1996) elaborate the situation in the 1970s. For the 1980s, reviews include Soysa *et al.* (1982), Sivasubramaniam (1985), IPFC (1987 a and b), APO (1988), Pauly and Chua (1988), and Pauly (1989). More recently, FAO (1992, 1995a and b), Yanagawa and Wongsanga (1993) and Hotta (1996) provide detailed situational updates.

We have avoided the detailed conventional review approach for this synopsis. The works cited above and the country-specific contributions to this volume provide sufficiently detailed treatments. We have concentrated instead on drawing from the available literature the commonalities in the main issues and opportunities occurring across the countries and logically structuring them into generic categories. Many of the problems have been building up for some time and now lead to inescapable conclusions. In many respects the substance of the required solutions remains the same, though the debate over implementation strategies to effectively resolve the problems continues vigorously.

We first provide, by way of background, some basic features of coastal fisheries in tropical developing countries in Asia. A synopsis of the main fisheries management objectives pursued in these countries is then presented in generic categories based on the multiplicity of detailed objectives sought by management. Consideration of the objectives is a logical necessity for evaluating the existing situation versus the desired state. The main management issues are presented, using selected site-specific assessments for illustration. The key management interventions currently being emphasized to address these issues are then briefly discussed. Lastly, the structure of the objectives, issues and interventions is summarized and trends affecting the feasibility of management success are briefly discussed.

Sectoral Background

The scope of this study includes fisheries in coastal areas, from the shoreline to 200 m depth, situated within the area bounded by 60ºE longitude in the west, 135ºE longitude in the east, 10ºS latitude in the south, and 20ºN latitude or the coast of mainland Asia in the north (Figure 1). This geographical delineation includes the fisheries of 13 developing coastal states (excluding Singapore given its level of economic development and limited shelf area). Table 1 provides selected statistics pertaining to these countries, 5 in South Asia and 8 in Southeast Asia. They had a combined population of about 1.7 billion in 1996, the highest being in India and the lowest in the Maldives and Brunei Darussalam. Gross national product (GNP) per capita varied between $215 per annum (Cambodia) and $20,400 (Brunei Darussalam). It is generally low, with only 3 countries having a per capita GNP above $2, 000 (Brunei Darussalam, Malaysia and Thailand). High population growth, low incomes and underdevelopment characterize many of these countries, though accelerated economic growth is improving these conditions, particularly in Southeast Asia (ADB 1996).

The marine jurisdictorial area of the countries covered here is extensive, spanning an aggregate of about 13 million km^2. This is roughly 1.5 times the extent of their combined land area, totaling 8.5 million km^2. The extent of the declared exclusive economic zones (EEZ) is highest for Indonesia, India and the Philippines and is lowest for Brunei Darussalam, Cambodia and Bangladesh (WRI 1995). Despite the large marine area, however, only 35% (4.6 million km^2) of the aggregate EEZ consists of shallow, productive continental shelves. The most extensive shelves are found off Indonesia, India, Malaysia and Vietnam. The highest shelf to EEZ ratios are found in Malaysia, Bangladesh and Indonesia where over 50% of the EEZ consists of shelves. Longhurst and Pauly (1987) provide a review of the biophysical characteristics and ecology of the tropical

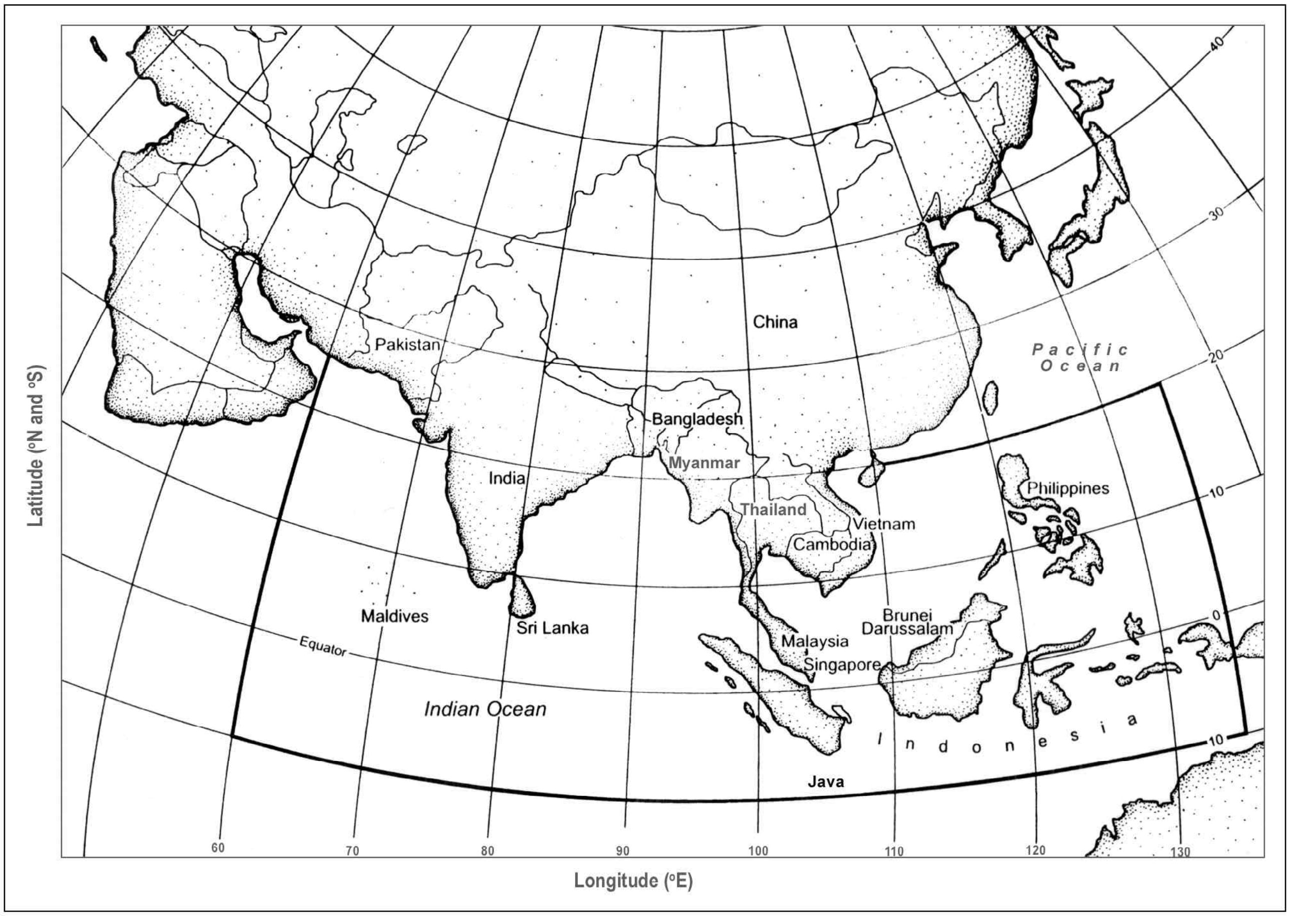


Figure 1. Map illustrating geographical scope of this study and the location of the developing countries covered.

Table 1. Selected statistics for tropical developing countries in Asia (ADB 1995, 1996; WRI 1995).

Country	Population (x 10^6; 1996)	Per Capita GNP($; 1995)	Land Area (x 10^3 km^2)	Exclusive Economic Zone (x 10^3 km^2)	Continental Shelf (0-200 m Depth)	
					Area (x10^3 km^2)	As % of EEZ
Bangladesh	124.0	283	144.0	76.8	55	72
Brunei Darussalam	0.3	20,400	5.8	38.6	9	22
Cambodia	10.2	215	181.0	55.6	15	27
India	943.7	335	3,287.6	2,014.9	452	22
Indonesia	197.6	940	1,904.6	5,408.6	2,777	51
Malaysia	20.6	3 930	329.8	475.6	374	79
Maldives	0.3	900	0.3	959.1	-	-
Myanmar	47.7	890	676.6	509.5	230	45
Pakistan	133.2	465	796.1	318.5	59	18
Philippines	69.3	1,130	300.0	1,786.0	178	10
Sri Lanka	18.2	660	65.6	517.4	27	5
Thailand	61.4	2,680	513.1	257.6	86	33
Vietnam	76.3	250	331.7	722.1	328	45
Total	1,702.8	-	8,536.2	13,140.3	4,588	35

Table 2. Selected 1994 fisheries statistics for tropical developing countries in Asia (FAO 1994; Hotta 1996).

Country	Total Fisheries Production (x 10^3 t $year^{-1}$)	Marine Fisheries Production (x 10^3 t $year^{-1}$)	Fishery Exports (\$ x 10^6 $year^{-1}$)	Per Capita Fish Consumption (kg•$year^{-1}$)	Number of Fishers (x 10^3)
Bangladesh	1,091	251	240	8.2	55
Brunei Darussalam	6	6	-	21.9	2
Cambodia	103	30	14	12.0	75
India	4,540	2,420	1,125	4.0	3,837
Indonesia	4,060	2,970	1,583	15.5	1,523
Malaysia	1,173	1,053	325	29.5	100
Maldives	104	104	37	126.0	22
Myanmar	824	599	103	15.5	696
Pakistan	552	418	153	2.2	308
Philippines	2,657	1,666	533	36.1	733
Sri Lanka	224	211	32	16.3	98
Thailand	3,432	2,798	4,190	25.3	61
Vietnam	1,155	817	452	13.4	266
Total	19,921	13,343	8,787	8.7	7,777

waters discussed here and point to the significance of coastal shelves to fisheries productivity. Moreover, mangroves, coral reefs and seagrasses line the coastal fringes of these shelves and enhance their productivity particularly in Southeast Asia where the peak in biodiversity of these habitats occur (McManus 1988; Fortes 1988, 1995). These coastal habitats are coming under increased stress from various human activities due to expanding populations and economies (Gomez *et al.* 1990; Sen Gupta *et al.* 1990; Chou 1994; Holmgren 1994; and Wilkinson *et al.* 1994).

Table 2 summarizes selected fisheries statistics of these countries for 1994. Annual fisheries production range from 6,000 t (Brunei Draussalam) to 4,540,000 t (India), with over half of the countries producing over 1 million t each. Overall fisheries production, including inland fishery and aquaculture, was about 20 million t, or a little over 18% of global fisheries production. Export of fish and fishery products was about $8.8 billion, representing a significant source of foreign exchange for these economies. Over $1 billion in fishery exports was registered by three countries, Thailand, Indonesia and India. Hotta (1996) estimates employment in fisheries (inland and marine fisheries, as well as aquaculture) to be about 11 million. Fish has traditionally been an important part of the diet of the population, particularly in Southeast Asia. Per capita fish consumption is highest in the Maldives, followed by the Philippines, Malaysia, Thailand and Brunei Darussalam, with annual consumption exceeding 25 kg. The lowest per capita consumption is in the three South Asian countries, namely: Pakistan, India and Bangladesh. These statistics indicate fisheries to be an important source of food, employment and foreign exchange.

Table 2 also summarizes marine fisheries catches. Aggregate marine fisheries catches were about 13.3 million t (representing roughly 16% of world marine landings), which constitutes 67% of the total fisheries production for these countries. Hence, marine fisheries contributes the bulk of fisheries production. Marine fisheries production varied between 6,000 t (Brunei Darussalam) and about 3 million t (Indonesia). Five countries, Indonesia, Thailand, India, the Philippines and Malaysia, registered marine fisheries landings exceeding 1 million t, which is indicative of extensive coastal fisheries. It is estimated that about 7.8 million fishers are working in marine fisheries in the 13 countries covered here. The number of full-time and part-time fishers varies between 1,600 in Brunei Darussalam and about 3.8 million in India, and millions more are involved part time, including women and children (Pauly 1997). The bulk of marine fisheries yields and employment originates from fishing operations in shallow, coastal shelves, indicating that coastal fisheries account for a substantial part of the food and employment generated by the fishing sector and contributes significantly to foreign exchange earnings via export of shrimps, small pelagics and demersals.

The coastal fishery resources consist of highly diverse, multispecies complexes (Pauly 1979; Longhurst and Pauly 1987). These are dominantly species with relatively high growth, natural mortality and turnover rates (Raja 1980; Ingles and Pauly 1984; Sivasubramaniam 1985; Chullasorn and Martosubroto 1986; Dwiponggo *et al.* 1986; and data in FishBase, Froese and Pauly 1996). A common feature of these resources is that they frequently exhibit maximum abundance in nearshore, shallow areas. Figure 2

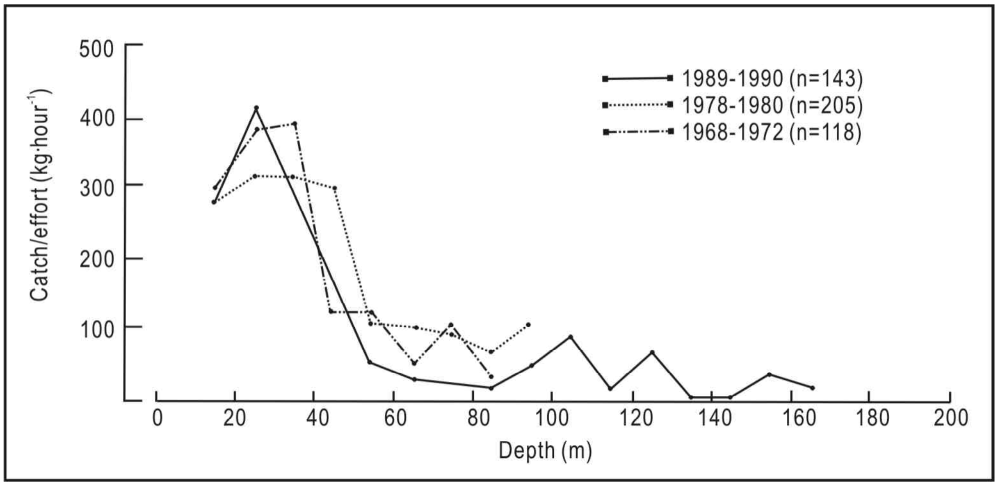


Figure 2. Fish abundance off Brunei Darussalam (based on trawl surveys conducted around 1970, 1980 and 1990) typical of variation in resource abundance with depth observed in South and Southeast Asia (Silvestre and Matdanan 1992).

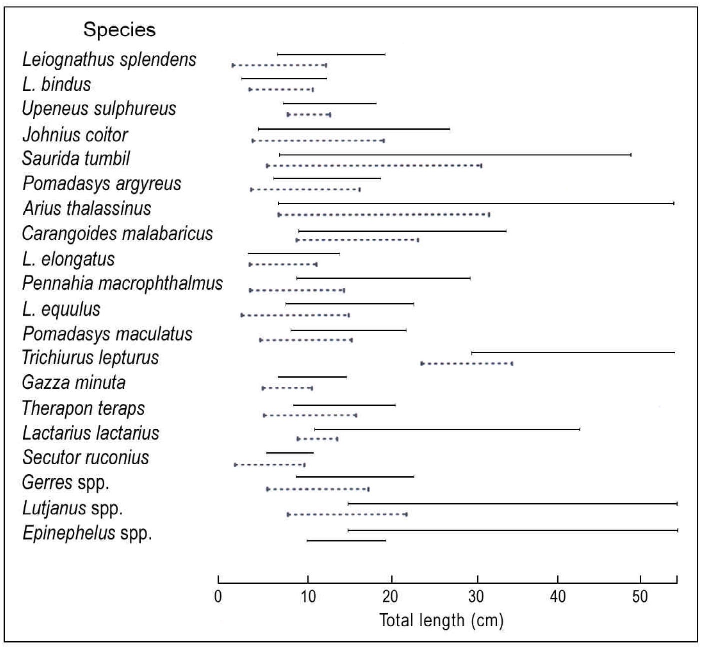


Figure 3. Size range of fishes caught in areas less than (dashed line) and more than (solid line) 15 m depth off Brunei Darussalam illustrating trend of increasing fish sizes with depth observed in South and Southeast Asia (Silvestre and Matdanan 1992).

illustrates the depth distribution of resource abundance off Brunei Darussalam. Note that catch rates observed through time consistently show peak abundance in waters less than 50 m. Such a distribution of resource abundance is widespread across the South and Southeast Asian area. This is very different from the situation prevailing in the North Atlantic (which provided the early models for fisheries development and industrialization in South and Southeast Asia), where commercially viable fish abundance occurs down to depths of 1 km and more.

Another feature of these coastal fishery resources is that many of the species exhibit increasing size with depth. Figure 3 illustrates the size range of fishes in shallow (less than 15 m depth) versus deeper waters off Brunei Darussalam (Silvestre and Matdanan 1992). This highlights the significance of nearshore areas as nursery grounds and the serious implications of concentrated small and large-scale fishing in these areas. The abundance of very valuable shrimps only in nearshore waters and the favorable concentration of finfishes in areas less than 50 m depth has encouraged the concentration of fishing effort and incursion of trawlers in shallow grounds.

The abundance and diversity of coastal fishery resources have supported vibrant, small-scale fisheries for centuries in these countries (Butcher 1996). The period between the two world wars saw various attempts to "modernize" these fisheries. These efforts were generally unsuccessful for a variety of technical and social reasons, not least of which includes the lack of dynamism of late colonial societies (Butcher 1994). The period immediately following the Second World War was different. Starting in the Philippines, a wave of technology and investments occurred which rapidly developed the demersal and, later, the pelagic fisheries in Southeast Asia (Pauly and Chua 1989). Mechanization of coastal fisheries also occurred in South Asia, although it appears to have been more diffuse.

A multiplicity of gears are currently used to exploit the multispecies resources. These vary from relatively simple, inexpensive gears, like handlines and gillnets, using no water craft or dug-outs, to large trawls and

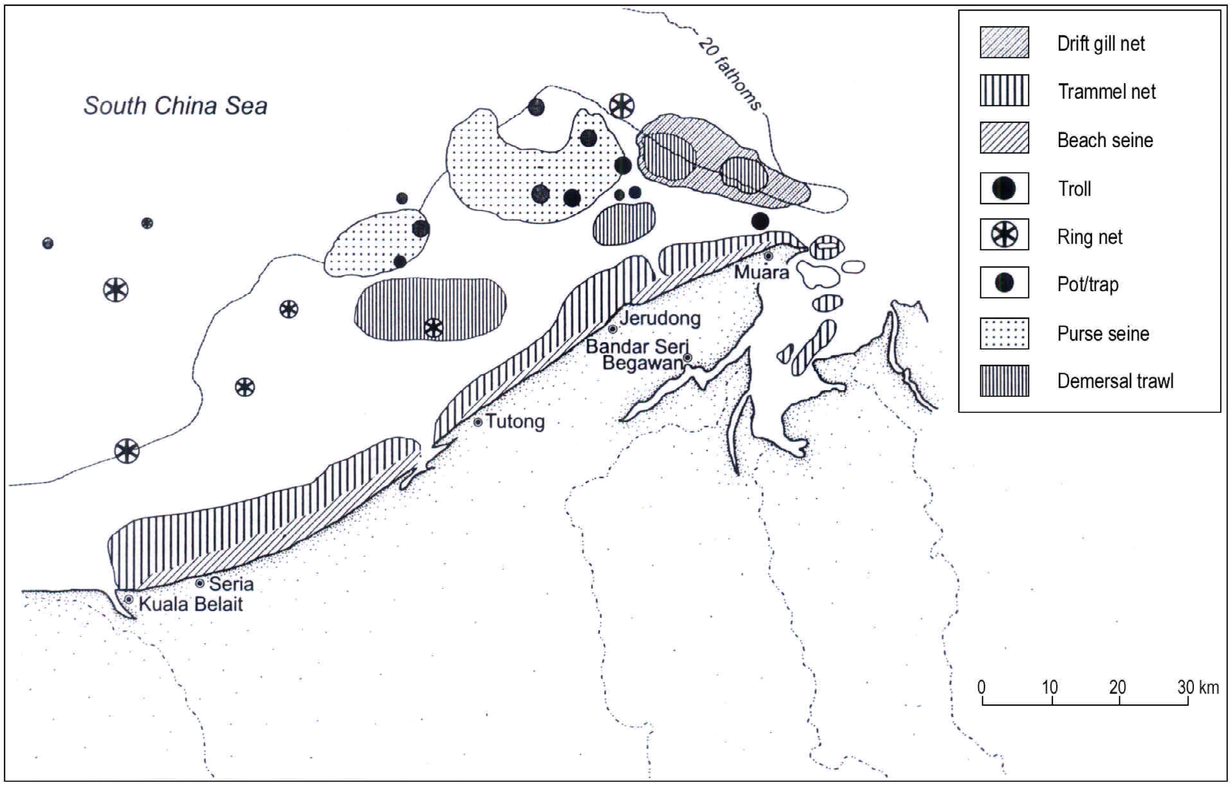


Figure 4. Fishing area by gear type off Brunei Darussalam typical of those observed in other coastal areas in South and Southeast Asia (Khoo *et al*. 1987).

purse seines using boats with powerful inboard engines. Sequential (and overlapping) deployment of these gears and small/large-scale duality of coastal fisheries are common features. Figure 4 illustrates these features in the case of Brunei Darussalam. The mix of gears used are concentrated in shallow grounds where abundance, catch rates and shrimp availability are highest. Many of the species are fished sequentially by different gears as they grow and move to deeper, offshore areas. Varied technological and biological interactions characterize the coastal fisheries exploitation regimes, making assessment and management rather difficult (FAO 1978; Pauly 1979; and Pauly and Murphy 1982).

The situation in Brunei Darussalam is unique in that the levels of exploitation are so low that major management problems have not occurred so far (Silvestre and Matdanan 1992). In the other countries, however, a heavy concentration of small and large-scale gears in many shallow coastal waters has led to overfishing, gear conflicts and dissipation of economic rent. Recent assessments have noted the increasing trend of overfishing of coastal fish stocks and habitat degradation (FAO 1995a; APFIC 1996). This has serious implications for fish supply as well as other benefits derived from coastal fisheries. In these countries, food fish consumption is projected to grow from an aggregate of 14.2 million t in 1992 to 20 million t by 2010 (Hotta 1996).

Overview of Main Fisheries Management Objectives

Fisheries management may be viewed as a dynamic resource allocation process where the ecological, economic and institutional resources of a fisheries exploitation system are distributed with value to society (in the broad sense) as the overall goal. Some recent works covering the status of fisheries management science and related concepts are Anderson (1987); Caddy and Mahon (1995); Olver *et al*. (1995); Stephenson and Lane (1995); Williams (1996); and Caddy (in press). The fisheries management process includes the resolution of normative and empirical debates to determine the direction of resource allocation decisions. What constitutes value to society is ultimately determined in the political field, and highly influenced by existing needs (or perceptions of such needs), available knowledge and information (or access to them), and religious and cultural values or norms in society.

The coastal fisheries discussed here are set in a variety of natural and human conditions. There is, therefore, a wide diversity of specific objectives being pursued in their management. These objectives may be gleaned from national legislations, development plans and fisheries project documents. Some objectives are implicitly rather than explicitly stated, and many have been noted to be conflicting or incompatible when pursued simultaneously (Lawson 1978; Lilburn 1987). From the available literature, we will summarize these diverse objectives into generic categories of objectives and management directions.

Figure 5 gives a schematic representation of the conventional "fishing system" framework in fisheries management. The arrows indicate the interactions between and among components of fishery resources and the fisheries relying on these. The framework emphasizes the essential dependence of fisheries on available resources for continued viability and a sustained flow of goods and benefits. It is a widely recognized principle of management in these countries that fisheries management systems must set up fishing regimes that appropriately match the productive capacity of the resource base.

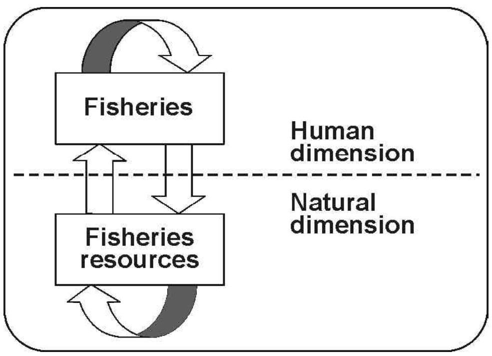


Figure 5. Schematic representation of the conventional "fishing system" framework in fisheries management.

Another feature of coastal fisheries management is the widening scope of "fisheries management" itself. Given the increasing multiplicity of issues impacting many coastal fisheries, fisheries management concerns (and objectives) have taken on a wider framework and scope of action in many areas. Figure 6 illustrates an example of the scope of multidisciplinary work conducted in San Miguel Bay, Philippines (Silvestre 1996). This encompasses: (1) fishery resources and the habitats (e.g., coral reefs, mangroves) and habitat characteristics (e.g., water quality) which sustain them; (2) other activities (e.g., forestry) which impact fisheries, fishery resources and natural environment; and (3) socioeconomic development and policy framework within which fisheries and other economic activities operate. Similar to the situation in San Miguel Bay, coastal fisheries management in the South and Southeast Asian region increasingly entails the implementation of a wide range of measures within the confines of the traditional fisheries sector, as well as interventions requiring coordination with other sectoral agencies (e.g., forestry, agriculture) at various levels of the institutional hierarchy.

Within this frame of reference, Figure 7 gives the typical hierarchy of objectives sought in the management of coastal fisheries in these countries. Consistent with sustainable coastal fisheries development as the overall goal, management entities attempt to: (1) optimize productivity / efficiency of the fisheries exploitation regime; (2) ensure that the benefits of production or improved productivity are distributed equitably; and (3) ensure that the productivity generated results in minimum damage to the resource base and the supporting natural environment. Environmental integrity also encompasses the intergenerational equity concerns embodied in the sustainable development concept of the Brundtland Commission report (WCED 1987). These three objectives are not always mutually compatible and the optimal balance among the three is highly dependent on situational realities and have been noted to vary temporally and spatially within individual countries. Apart from the three generic ("ends") objectives above, appropriate management systems / regimes are sought to effectively attain a balance among these objectives. Hence, institutional effectiveness is a fourth generic category of ("means") objective sought in coastal fisheries management in South and Southeast Asia.

Figure 7 also gives typical "third-level" objectives commonly encountered. These are translated into a number of policy instruments and management measures taking the form of regulatory instruments, market-based incentives, institutional measures, research agendas and / or government support investments. For example, the licensing scheme in many countries has productivity as the main rationale. The Indonesian trawl ban (Sardjono 1980) and the 15-km exclusive municipal fishing zones in the Philippines had equity as their primary consideration. The ban on the use of poisons and explosives in fishing in many countries has environmental integrity as the main driving force.

The Challenges: Overview of Key Management Issues

Coastal fisheries in the tropical developing countries of South and Southeast Asia operate in a spectrum ranging from light fishing, essentially single sector (i.e., fisheries) situations, to intense fishing and multisector use of the coastal area (and its adjacent

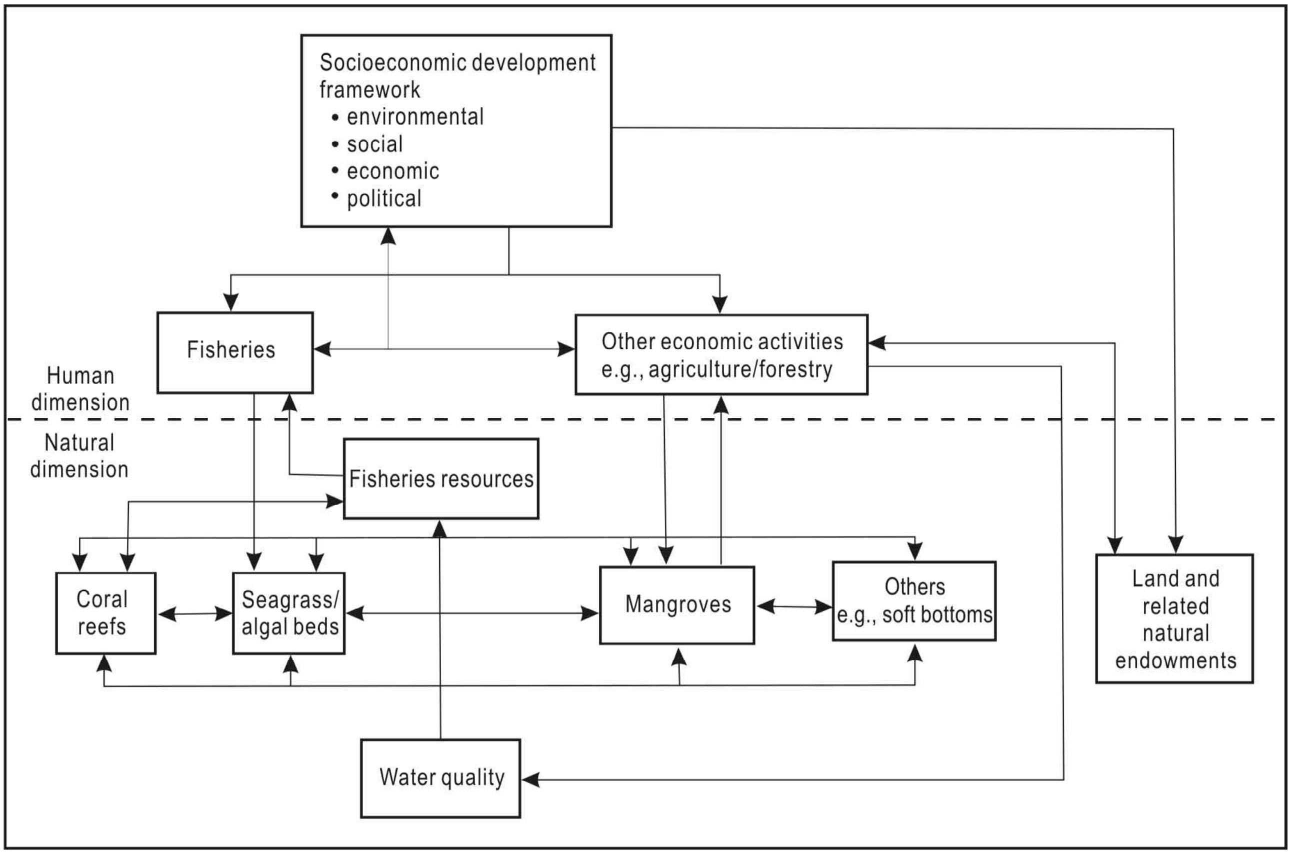


Figure 6. Schematic representation of an expanded framework for fisheries management. Interrelations among the fisheries resources, the fisheries exploiting them, and other components of the human and natural dimensions are illustrated by arrows (Silvestre 1996).

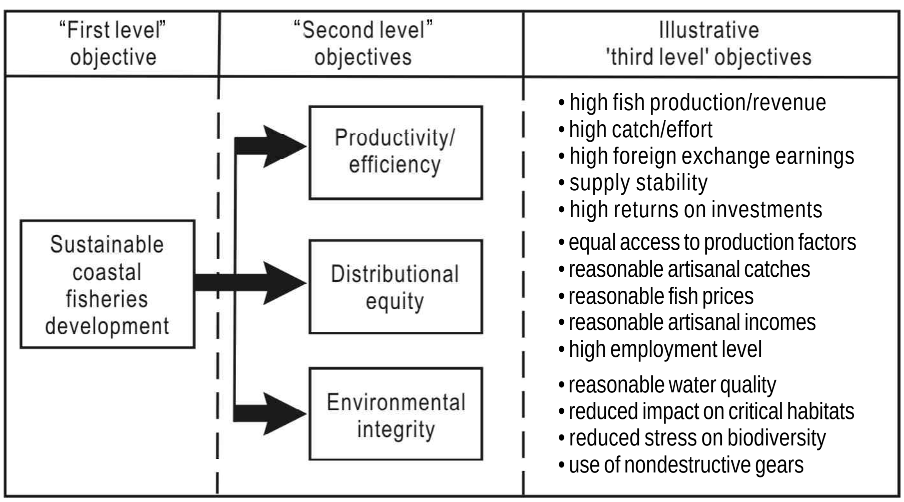


Figure 7. General goal and objectives in fisheries management.

terrestrial and marine zones). The number of negative factors impacting coastal fisheries multiply through this range, requiring increasingly comprehensive approaches and wider scope of action to sustain fisheries benefits. Many coastal fisheries are in (or moving into) the more industrialized, intensive stages of the fishing and coastal use spectrum, necessitating improved management efforts. We briefly outline below the main issues which require increased management attention.

Excessive fishing effort

High levels of fishing effort on coastal fish stocks, particularly in nearshore traditional fishing grounds, is a common management concern (Yanagawa and Wongsanga 1993; FAO 1995a and b; APFIC 1996; Hotta 1996). High fish demand (due to increasing population and incomes), burgeoning fishing populations combined with a lack of livelihood opportunities in rural areas, advances in fishing technology and accelerated industrial fisheries development have led to excessive fishing pressure and overfishing in many coastal areas. This has resulted in a leveling-off (if not decline) in landings; reduced catch rates, incomes and resource rents; and intense competition and conflict among fishers. Figure 8 illustrates the gravity of the issue of excessive fishing effort evident in some areas. In the case of the demersal and small pelagic fisheries in the Philippines (which are concentrated in very shallow waters), by the mid-1980s the level of effort exceeded what was required to harvest maximum economic yield by 150-300% and maximum sustainable yield by 30-130%. This implies dissipation of resource rents of about $450 million annually for the demersal and small pelagic fisheries combined. The developing countries of South and Southeast Asia can ill afford the economic losses resulting from overfishing. Although there are coastal areas which remain lightly fished (e.g., sparsely populated eastern Indonesia, parts of East Malaysia), the general consensus is that few coastal fish stocks can accommodate an expansion in fishing effort, and that many coastal fisheries in nearshore areas (particularly in the Gulf of Thailand, the Philippines, Bay of Bengal and western Indonesia) require significant reductions in fishing effort (Pauly and Chua 1988; FAO 1995a; APFIC 1996; Hotta 1996).

Inappropriate exploitation patterns

Inappropriate patterns of exploitation have led to suboptimal benefits from the exploitation of coastal fishery resources. This stems from the species and size selectivity of the mix of fishing gears used, i.e., their technological characteristics and spatio-temporal deployment in coastal fishing grounds. The selectivity of fishing gears and techniques for their assessment are well documented in the literature (Hamley 1975; Pope *et al.* 1975; Sainsbury 1984; Silvestre *et al.* 1991). The theory of fishing illustrates the utility of influencing selectivity to maximize fish yields and related benefits (Beverton and Holt 1957; Ricker 1975; Gulland 1983). Armstrong *et al.* (1990) provide an update on the importance of selectivity to the conservation of fish stocks.

The concentration of fishing effort in shallow, coastal shelves is a problem across many areas in South and Southeast Asia. The use of explosives and poisons in fishing is also rampant in certain places. The use of fine-meshed nets by artisanal fishers in nearshore areas to catch fish (as well as milkfish and shrimp seeds for aquaculture) is a serious concern. The use of small-meshed nets by trawlers is leading to substantial losses. Figure 9 illustrates the results of multispecies yield and value per recruit assessment of the trawl fishery operating in the Lingayen Gulf, Philippines. Note that the use of small-meshed (i.e., 2 cm) trawl codends is leading to losses of up to 20% and 35% of potential yield and value, respectively.

Post-harvest losses

The magnitude of post-harvest losses is another

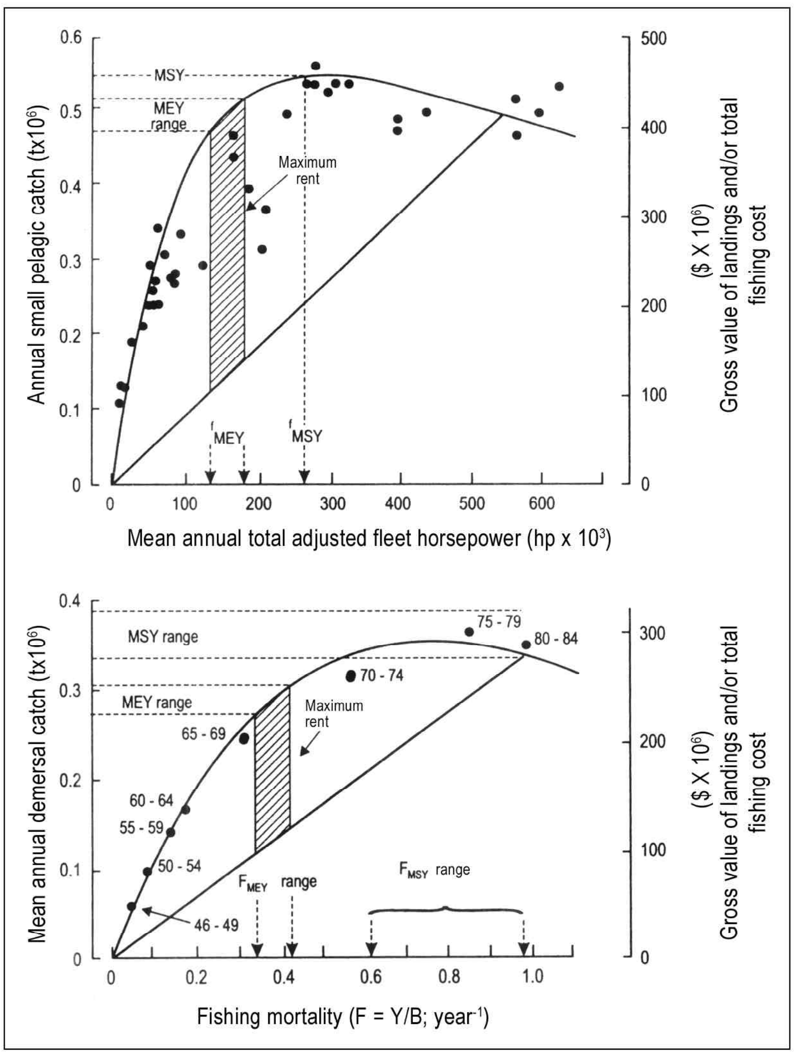


Figure 8. Surplus production models of the Philippine small pelagic and demersal fisheries (Silvestre and Pauly 1986; Dalzell *et al.* 1987).

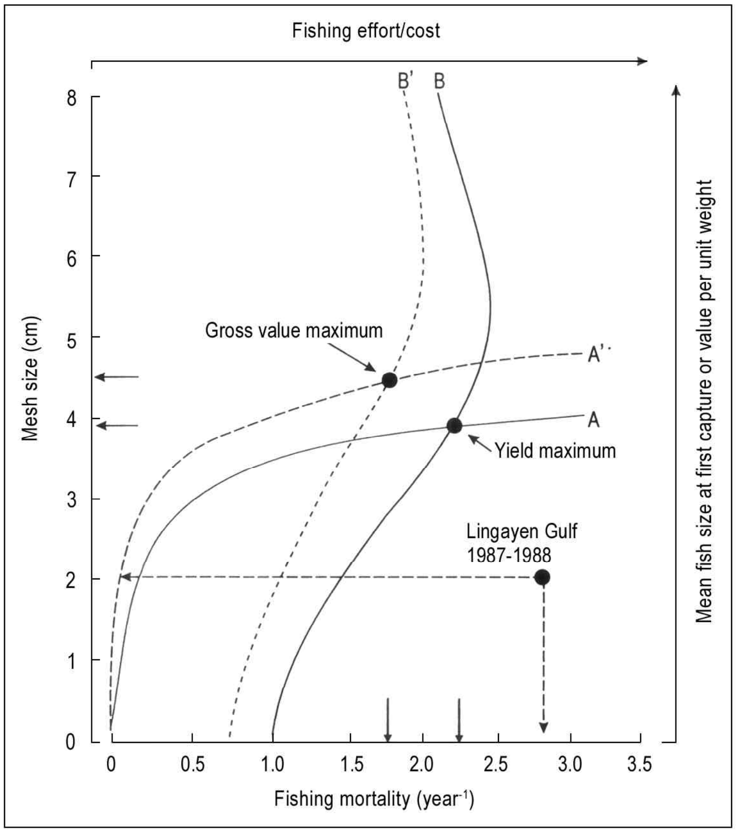


Figure 9. Multispecies yield and value per recruit assessment of the trawl fishery in Lingayen Gulf, Philippines (Silvestre 1990). Intersections of the "eumetric" and "cacometric" lines for yeld (A and B) and gross value (A' and B') indicate mesh size and fishing mortality combinations where yield and value are maximized. Note excessively high effort and low mesh sizes in Lingayen Gulf which lead to losses of up to 20% and 35% relative to maxima in yield and value, respectively.

major concern. Alverson *et al.* (1994) estimate the extent of discards for the fishing areas discussed here to be over 5 million t. This is broken down as follows: western central Pacific – 2.8 million t; eastern Indian Ocean -0.8 million t; and Western Indian Ocean – 1.5 million t. This level of discards is high at roughly 40% of marine landings of the 13 developing countries covered here. There are doubts about the accuracy of these estimates, based as they are on limited observations with small spatio-temporal coverage, and better figures will become available in the coming years. However, we believe the level to be significant (see for example Khan and Alamgir, this vol.) for countries with substantial trawl fleets and a limited market for low-value marine fishes. Apart from discards, the extent of physical losses due to spoilage of landings should be limited given the possibility of conversion to fish sauce and related products (Pauly 1996a). Value loss of harvests due to reduced quality is a common concern.

Large and small-scale fisheries conflicts

The question of who should have access and, thus, benefit directly from the use of coastal fishery resources is a primary consideration in the management of fisheries. Increased competition and conflict between the small and large-scale fishing sectors is characteristic of many coastal fisheries (Thomson 1988). Table 3 illustrates the uneven competition between the small-scale (i.e., municipal) and large-scale (i.e., trawl) fisheries in San Miguel Bay, Philippines. The trawlers, consisting of 89 units and belonging to only 40 households, obtain 85% of pure profit, 42% of catch value and 31% of the total catch in the San Miguel Bay fishery. The rest goes to 2,300 small-scale fishing units owned by 3,500 households and employing about 5,100 fishers. Social equity and relative factor endowments (i.e., abundant labor and limited capital) in these countries often require the resolution of these conflicts in favor of the small-scale sector, as occurred in Indonesia, the Philippines, Malaysia and Bangladesh. Competition and conflict persist due to the economic and political power of the industrial sector and require increased management and enforcement efforts.

Habitat degradation

Coastal fish stocks and the coastal environment which sustains them are coming under increased stress from fishing and other economic activities. On an onshore-offshore axis, Table 4 summarizes ongoing

Table 3. Summary of data on the duality of the fisheries in San Miguel Bay, Philippines (Smith *et al.* 1983).

Parameter	Medium + Small Trawlers	Small-scale Fishery
Number of fishing units	89	2,300
Total horsepower	13,200	5,600
Number of owners	40	2,030
Number of households	40	3,500
Crew income/month (P) [a]	339-810	164-342
Number of fishers	500	5,100
% of total catch	31	69
% of total catch value	42	58
% of total rent	85	15

[a] Then $1=P10.

Table 4. Generic coastal transect summarizing main activities and issues relevant to coastal fisheries and integrated coastal zone management in South and Southeast Asia.

	Terrestrial			Coastal		Marine	
Major Zones	**Upland (>18% slope)**	**Midland (8-8% slope)**	**Lowland (0<8% slope)**	**Interface (1 km inland from HHWL-30 m depth)**	**Nearshore (30 m-200 m depth)**	**Offshore (>200 m depth-EEZ)**	**Deep-Sea (beyond EEZ)**
Main Resource Uses/Activities	Logging Mining Agriculture	Mining Agriculture	Urban development Industries Agriculture Tourism	Mining (coral/sand) Mangrove forestry Aquaculture Fisheries Tourism Industries Urban development	Artisanal fisheries Commercial fishing Marine transport Oil drilling	Marine transport Industrial fishing Offshore development	Marine transport Industrial fishing
Main Environmental Issues/Impacts on the Coastal Zone	Siltation Flooding Toxic mine tailings	Agrochemical loading Erosion Siltation Flooding	Siltation Domestic pollution	Reduced biodiversity Habitat degradation and destruction Overfishing Industrial pollution Domestic pollution	Reduced biodiversity Overfishing Oil spills	Overfishing Oil spills	Oil spills

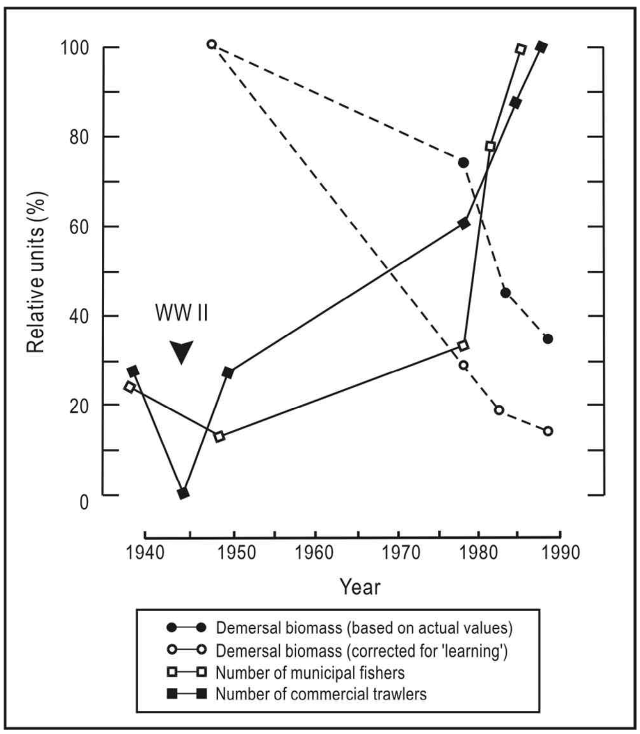


Figure 10. Relative indices of demersal biomass, number of fishers, and number of commercial trawlers in Lingayen Gulf, Philippines from the 1930s to the 1980s (Silvestre 1990).

economic activities in coastal and adjacent terrestrial and marine zones. The table also provides a summary of the main impacts of these activities on the coastal environment. The use of explosives and poisons in fishing occurs in many coastal fishing grounds, leading to degradation of coral reefs (Gomez 1988; Pauly and Chua 1988; Silvestre 1990; Chou 1994). Trawling in coastal areas damages patch reefs as well as seagrass and soft-bottom communities (Longhurst and Pauly 1987).

Localized pollution, particularly in semi-enclosed coastal waters, is increasing in frequency due to pollutants from domestic, industrial, agricultural and mining sources (Gomez *et al.* 1990; Sen Gupta *et al.* 1990; Holmgren 1994; APFIC 1996; Hotta 1996). Deforestation is leading to increased flooding and alteration of hydrological regimes in coastal areas. The degradation of coastal habitats (e.g., coral reefs, mangroves, and seagrass/algal beds) is apparent in many areas due to the combined effects of siltation, pollution, alteration of hydrological regimes, habitat conversion and extractive activities like coral/sand mining and mangrove forestry (Fortes 1988; Chou 1994; Holmgrem 1994; Wilkinson *et al.* 1994; Koe and Aziz 1995). Moreover, the threat of potential oil spills is increasing given increased oil tanker traffic and marine transport in the area. All these impacts have repercussions on coastal biodiversity and on the productivity of coastal fishery resources. For instance, the biomass decline associated with high effort in the surplus production models given in Figure 8 may be aggravated by the degradation of coastal habitats in the Philippines (Barut *et al.*, this vol.).

Inadequacy of information and research

The inadequacy of information and research inputs into the complex decisionmaking process that constitutes coastal fisheries management is a commonly raised issue. The appropriateness of the scope, elements, timeliness and accuracy of the available statistical information has often been questioned. Many countries require improvements in fisheries statistics and databases to make real-time management of coastal fisheries feasible (see for example FAO/SEAFDEC/SIFR 1994). Figure 10 illustrates the patchiness of information for conducting site-specific assessment in these countries. In this example from the Lingayen Gulf (Philippines), the spatial scope of available catch statistics does not meet assessment needs and effort information is not available. Assessment of the status of fisheries in the area is, therefore, possible only based on the results of independent trawl surveys and population censuses conducted in the past. The published results of these surveys and censuses allowed Silvestre (1990) to show that resource biomass was down to about 13% of its original level in the late 1940s, precluding further expansion of the fisheries.

The inadequacy of fisheries research in support of fisheries management efforts is also commonly cited. Much of the fisheries research is criticized for being too academic and peripheral to the management questions at hand, and for failing to take the extra step to elaborate requisite management options and measures. Many research results also remain unpublished leading to what Pauly (1995) refers to as the "shifting baseline syndrome" in fisheries. The short history of quantitative fisheries research, limitations in the available statistical baseline and limited research resources require that past studies be documented, analyzed and made available for fisheries management purposes. For example, trawl surveys conducted in many countries remain underutilized and potentially offer many insights for fisheries management (Silvestre *et al.* 1986; Pauly and Martosubroto 1996). Other areas commonly lacking research and information include: site-specific fisheries assessments; selectivity research; research on location and size of underfished stocks; marine protected areas; fish processing and marketing; socioeconomic research; and policy and institutional studies (IPFC 1987b; Yanagawa and Wongsanga 1993; FAO/SEAFDEC/SIFR 1994; APFIC 1996; Hotta 1996).

Institutional weaknesses and constraints

All these issues and concerns arise and persist due to the inability of existing institutions to deal with the changing realities of coastal fisheries. Problems and constraints commonly cited include: inadequacies in the policy and legal framework; limited personnel and technical capabilities; shortage of resources/funding; inadequate or overlapping mandates and functions; and a lack of institutional collaboration/coordination (IPFC 1987a and b; APFIC 1996; Hotta 1996). An increased emphasis on the participation of stakeholders and devolution of management authority to local levels are notable trends in many of the countries included in this study.

The Opportunities: Overview of Key Management Interventions

Given the multiplicity of issues impacting coastal fisheries, a variety of management interventions are prescribed in the available literature for their resolution or mitigation (Yanagawa and Wongsanga 1993; FAO 1995a and b; APFIC 1996; and Hotta 1996). We briefly outline below seven main categories of management interventions which we believe to be appropriate, given the status of coastal fisheries in these countries. Though many of these are in place, there is a common concern about the comprehensiveness and scale of the existing mix of measures to sufficiently reverse or mitigate the multiplicity of impacts on, and sustain the benefits derived from, coastal fisheries. Successful fisheries management will require effective implementation of a wide range of measures as well as fundamental shifts in management perspectives (Anderson 1987; Hilborn and Walters 1992; Pauly 1994, 1996b; Olver *et al.* 1995; Stephenson and Lane 1995; Caddy, in press).

Limited entry and effort reduction

The establishment of viable systems of rights and access to limit entry into coastal fisheries is sorely lacking. Licensing schemes in many countries are still viewed as statistical and revenue generating exercises, rather than as effective management handles to limit entry and control fishing effort. In overfished coastal areas, the obvious need is for a reduction of fishing effort, particularly in nearshore, traditional fishing grounds. The requisite effort reduction in some areas is quite substantial as in the example for Philippine demersal and small pelagic fisheries shown in Figure 8. In this case the reduction required is about half of prevailing effort levels. This kind of situation requires direct exit interventions, enhancement of alternative livelihood prospects and occupational mobility of fishers, restructuring of relevant policy and regulatory frameworks, and the redirection of subsidies and support towards improved rural/community development. Other measures outlined below are also directly relevant to requisite effort reduction schemes in overfished coastal fisheries.

Gear, area and temporal restrictions

Measures influencing the species and size, and to a certain extent the sex and maturity stage, composition

Table 5. Illustrative examples of regulatory instruments affecting the selectivity of fishing operations in the Philippines (Silvestre 1995).

Regulatory Instrument	Law/Ordinance[a]	Specifications
1. Technological controls		
- mesh regulation	PD 704 (1975)	Prohibition of use of nets with mesh sizes less than 3 cm when stretched (nationwide).
	FAO 155 (1986)	Regulating the use of fine-meshed nets in fishing (nationwide).
- "gear" ban	PD 704 (1975)	Prohibition of commercial trawling (less than 3 GT) in waters 7 fathoms deep or less (nationwide).
	FAO 163 (1986)	Prohibition of operation of *muro-ami* and *kayakas* in all Philippine waters (nationwide).
	FAO 188 (1993)	Regulations governing the operation of commercial fishing boats in Philippine waters using tuna purse seine nets (nationwide).
	FAO 190 (1994)	Regulations governing *pa-aling* fishing operation in Philippine waters (nationwide).
	PD 704 (1975)	Prohibition of use of explosives and poisons in fishing (nationwide).
2. Spatial restrictions		
- area closure	PD 704 (1975)	Prohibition of commercial fishing (with the use of boats more than 3 GT) in waters less than 7 fathoms (nationwide).
	LOI 1328 (1983)	Extended the ban on commercial trawls and purse seines within 7 km of the coastline in all provinces (nationwide).
	RA 7160 (1992)	Extended boundaries of municipal waters from 3 nautical miles (5.5 km) to 15 km from the shoreline (nationwide).
3. Temporal restrictions	FAO 9 (1950)	Regulation governing the conservation of the *ipon* goby fisheries of the Ilocos provinces; open season from November to January; closed season in September, October and February (area specific i.e., Ilocos Norte).
	FAO 136 (1982)	Closed season of five years for the operation of commercial fishing boats in San Miguel Bay (area specific).
4. Others	FAO 129 (1980)	Ban on the taking or catching, selling, possession, and transportation of *sabalo* (full grown *bangus* or milkfish) (nationwide).
	FAO 148 (1984)	Regulation for gathering, catching, taking or removing of marine tropical aquarium fish (nationwide).

[a] FAO - Fishery Administrative Order; PD - Presidential Decree; LOI - Letter of Instruction.

of catches include: (1) technological controls or limitations, e.g., gear restrictions such as mesh regulations, hook size control, trawl bans; (2) spatial restrictions, e.g., marine sanctuaries, area closures; and (3) temporal restrictions, e.g., seasonal closures. Regulatory instruments include various forms of species and size restrictions on landings, as well as prohibitions on landing of gravid females. Table 5 uses selected regulations in effect in the Philippines to illustrate some of the forms that these selectivity measures may take. It should be noted that a creative use of other measures, such as incentives / disincentives can be made to influence selectivity and the resulting exploitation pattern/levels of coastal fisheries.

While much of the theoretical and methodological aspects of gear selectivity are covered in the literature, there is a considerable scope for *in situ* information on selectivity to set up measures for site-specific management. Considerable opportunities exist for a more creative use of gear restrictions, zonation schemes, marine sanctuaries or protected areas (Bohnsack 1994), and seasonal closures to influence the selectivity of coastal fisheries (Silvestre 1995). The design and operation of measures to improve selectivity will vary depending on the number of species and fishing gears used. The complexity of the selectivity problem increases from single species, single gear situations to multigear, multispecies situations (Pauly 1979; Gulland 1983). This has hindered the more creative use of gear, area and temporal restrictions.

McManus (this vol.) points to faunal assemblages associated with spatial elements which can be tapped by managers in designing area restrictions, sanctuaries or zonation schemes (see also McManus 1986, 1989, 1996). The opening and closing of the fishing season for shrimps in Australia illustrates the potential for temporal restrictions, given similarities in the dynamics of exploited shrimp species (Rothlisberg *et al.* 1988; Staples 1991). Attention is also required in developing and dispersing appropriate hatchery techniques for cultured species, e.g., milkfish, shrimps, groupers. The restriction of gears with small-mesh nets in nearshore areas can succeed only if aquaculture dependence on wild seeds is curtailed.

Improvement of marketing and post-harvest facilities

The level of discards and (value) loss in catches require increased management intervention (Alverson *et al.* 1994). Post-harvest facilities (i.e., salt, ice and cold storage) are lacking in strategic locations in many areas. Private sector participation in providing these facilities needs to be enhanced given the noted inefficiency of the public sector in maintaining such facilities. Development and dissemination of appropriate processing (e.g., *surimi*) and handling techniques also require attention, as do the development and maintenance of rural road infrastructures. Improved selectivity of coastal fisheries is also important in reducing the magnitude of discards.

Enhancement of awareness and participation of stakeholders

Enhancing the awareness and participation of stakeholders is necessary for better and more cost-effective management of coastal fisheries. Improved transparency and institutionalized participation of stakeholders in the management decisionmaking process is desirable. Other measures that can be implemented include: enhancement of fishers' organizations and other NGOs; education / awareness programs; devolution / decentralization of management authority; and appropriate extension, training and credit support for nonfishing activities.

Reduction of environmental impacts

The need for a reduction of the impacts of fishing and other economic activities on the coastal environment that sustains fisheries is evident in many countries. Efforts toward integrated coastal zone management (Chua and Pauly 1989; Clark 1992) and the adoption of integrated coastal fisheries management approaches (Silvestre 1996) will be necessary for the reduction of undesirable impacts on the coastal environment. Other areas requiring intervention include: wider adoption of multiple-use zonation schemes; restoration / rehabilitation of coastal habitats; curtailment of destructive fishing methods; adoption of appropriate environmental impact assessment systems; and improvement and enforcement of penalties / incentives systems. Progress in the wider use of the precautionary approach and (development of mechanisms for) "internalization" of environmental costs is highly relevant to reducing coastal environmental impacts.

Institutional strengthening/upgrading

Concern about the issues above persists due to inability of existing institutions to elaborate and effect the requisite management interventions. Strengthening of the policy, regulatory and organizational frameworks relevant to fisheries is urgently required. The areas identified as needing attention include: technical, personnel and facilities upgrading; improvement of financial capability and strengthening of mandates of organizations; enhancement of organizational coordination / collaboration; increased transparency, accountability and participation in the management decisionmaking process; and the development of effective and cost-efficient monitoring, control and surveillance (MCS) systems (Flewelling 1995). The costs of improved management are substantial and exploration of appropriate cost-sharing schemes with industry (as the ultimate beneficiary) needs to be developed.

Enhancement of research and information

Management systems have to be supported by research and information There is need for research in: appropriate size and siting of sanctuaries or protected areas; resource enhancement and habitat rehabilitation techniques; selective fishing; appropriate fisheries management reference points; ecosystem modeling (Christensen and Pauly 1995, 1996); and policy and institutional support. Documentation and retrospective analysis of existing information and past studies (e.g., trawl surveys) is important for purposes of comparison and for the potential insights they provide for the management of coastal fisheries. Establishment of statistical baseline information should be consistent with MCS and management reference points appropriate to the situational realities obtained in the individual countries. There should be more research collaboration and exchange of research and experiences between the countries given similarities in their resource base and development context.

Conclusion

In the 13 developing South and Southeast Asian countries covered in this study, coastal fisheries generate food, employment and foreign exchange. Many factors impact the magnitude and sustainability of these benefits. Figure 11 shows a logical structuring of the main objectives, issues and interventions relevant to coastal fisheries management in these countries and also provides a summary of the main points covered in this paper. There are three generic categories of ("ends") objectives for the management of coastal fisheries, viz., productivity / efficiency, distributional equity and environmental integrity. A fourth generic ("means") category, institutional effectiveness / efficiency, is often considered necessary for success in attainment of the main ("ends") objectives. Seven key issues affect the attainment of these objectives and the benefits derived from coastal fisheries. Seven key management interventions for the resolution or mitigation of these issues are listed. The issues are interconnected and have cross-reinforcing tendencies, e.g., overfishing intensifies conflicts between small and large-scale fisheries leading to the use of destructive gears and increased habitat degradation. The management interventions are also interconnected, although only the link to the main issues being addressed is illustrated. Apart from providing a summary, Figure 11 in essence presents a systems matrix of generic elements which should be considered in advancing coastal fisheries management efforts in South and Southeast Asia.

Beyond the reflection and debate, Figure 11 illustrates the need for effective action on a wide front at various levels of the institutional hierarchy. The management interventions outlined in this paper show scope for action at the local, national and international levels. Much of the overall success will depend on national institutional capabilities. The strengthening and upgrading of these capabilities and effective implementation of the interventions outlined are in turn dependent on the resources that can be mobilized for such purposes. In the context of the development needs of these countries, there is competition for resources given other equally pressing developmental and social needs. The reviews given by Holdgate *et al.* (1982), Tolba and El-Kholy (1992), and FAO (1995b) identify positive and negative international trends affecting the environment, food, agriculture and fisheries particularly relevant to this study. High population growth, external debt burden, declining commodity prices, market access difficulties and the shrinking international aid "pot" are minuses for the ability of most countries to devote sufficient resources to the problems at hand. The positive developments are increased economic growth (although this can lead to more pollution problems), environmental awareness, democratization and regional collaboration. Thus, the ultimate solutions to the multiplicity of issues impacting coastal fisheries are also premised on addressing poverty and promoting overall development in South and Southeast Asia.

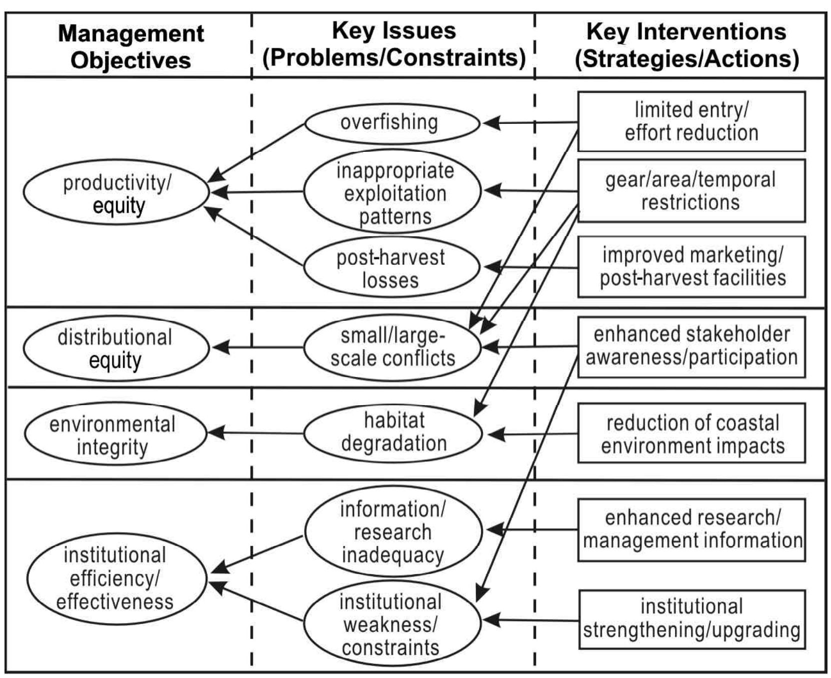


Figure 11. Summary of management objectives, key management issues and constraints, and interventions (strategies and actions) for the coastal fisheries of the developing countries of tropical Asia. Management interventions have crosscutting benefits/ implications, but only the connections to the main issue being addressed are illustrated.

Acknowledgments

Thanks are due Mr. Len Garces and Ms. Bing Santos for assistance in assembling some of the information given in the tables, and for locating important references used in this study.

References

ABD. 1995. Key indicators of developing Asian and Pacific countries. Vol. XXVI. Asian Development Bank, Manila. 417 p.

ADB. 1996. Asian development outlook - 1996 and 1997. Asian Development Bank, Manila. 245 p.

Alverson, D., M. Freeberg, S. Murawski and J.G. Pope. 1994. A global assessment of fisheries bycatch and discards. FAO Fish. Tech. Pap. (339): 233 p.

Anderson, L.G. 1987. Expansion of the fishery management paradigm to include institutional structure and function. Trans. Am. Fish. Soc. 116(3): 396-404.

Aoyama, T. 1973. The demersal fish stocks and fisheries of the South China Sea. FAO and UNDP, Rome. SCS/DEV/73/3: 80 p.

APFIC. 1996. Summary report of the APFIC Symposium on Environmental Aspects of Responsible Fisheries, Seoul, Republic of Korea, 15-18 October 1996. RAP Publ. 1996/42. Asia Pacific Fisheries Commission, Bangkok, Thailand. 27 p.

APO. 1988. Fishing industry in Asia and the Pacific. Asian Productivity Organization, Tokyo. 481 p.

Armstrong, U., R. Ferro, D. MacLennan and S. Reeves. 1990. Gear selectivity and the conservation of fish. J. Fish. Biol. 37 (A): 261-262.

Beverton, R. and S. Holt. 1957. On the dynamics of exploited fish populations. Fishery Invest., London, Ser. 2, 19: 533 p.

Bohnsack, J.A. 1994. Marine reserves: they enhance fisheries, reduce conflicts and protect resources. Naga, ICLARM Q. 17(3): 4-7.

Butcher, J. 1994. Harvesting the sea. An ecological history of the marine fisheries of Southeast Asia. Research School of Pacific and Asian Studies, Australian National University. 116 p.

Butcher, J. 1996. The marine fisheries of the Western Archipelago: towards an economic history, 1850 to the l960s, p. 24-39. *In* D. Pauly and P. Martosubroto (eds.) Baseline studies of biodiversity: the fish resources of Western Indonesia. ICLARM Stud. Rev. 23, 312 p.

Caddy, J.F. and R. Mahon. 1995. Reference points for fishery management. FAO Fish. Tech. Pap. (347): 82 p.

Caddy, J. F. Fisheries management after 2000: will new paradigms apply? Rev. Fish Biol. Fish. (In press).

Christensen, V. and D. Pauly. 1995. Fish production, catches and the carrying capacity of the world oceans. Naga, the CLARM Q. 18(3): 34-40.

Christensen, V. and D. Pauly. 1996. Ecological modeling for all. Naga, the ICLARM Q. 19(2): 25-26.

Chou, L.M. 1994. Marine environmental issues of Southeast Asia: state and development. Hydrobiologia 285: 139-150.

Chua, T.E. and D. Pauly, Editors. 1989. Coastal area management in Southeast Asia: policies, management strategies and case studies. ICLARM Conf. Proc. 19, 254 p.

Chullasorn, S. and P. Martosubroto. 1986. Distribution and important biological features of coastal fish resources in Southeast Asia. FAO Fish. Tech. Pap. (278): 84 p.

Clark, J.R. 1992. Integrated management of coastal zones. FAO Fish. Tech. Pap. (327): 167 p.

Dalzell, P., P. Corpuz, R. Ganaden and D. Pauly. 1987. Estimation of maximum sustainable yield and maximum economic rent from the Philippine small pelagic fisheries. Bureau of Fisheries and Aquatic Resources Tech Pap. Ser 10(3), 23p.

Dwiponggo, A., T. Hariati, S. Banon, M.L. Palomares and D. Pauly. 1986. Growth, mortality and recruitment of commercially important fishes and penaeid shrimps in Indonesian waters. ICLARM Tech. Rep. 17: 91 p.

Dwiponggo, A. 1988. Recovery of overexploited demersal resources and growth of its fishery on the north coast of Java. Indones. Agric. Res. Dev. J. 10(3): 65-72.

FAO. 1978. Some scientific problems of multispecies fisheries. Report of the Expert Consultation on Management of Multispecies Fisheries. FAO Fish. Tech. Pap. (181): 42 p.

FAO. 1992. Review of the state of world fishery resources. Part 1. The marine resources. FAO Fish. Circ. (710). Rev 8. Part 1. 114 p.

FAO. 1994. FAO yearbooks. Fishery statistics. Vol. 78, 702 p.

FAO. 1995a. Review of the state of world fishery resources: marine fisheries. FAO Fish. Circ. (884): 105 p.

FAO. 1995b. The state of world fisheries and aquaculture. FAO, Rome. 57 p.

FAO/SEAFDEC/SIFR. 1994. Status of fishery information and statistics in Asia. Proceedings of the Regional Workshop on Fishery Information and Statistics in Asia, Bangkok, Thailand, 18-22 January 1994. Vols. I and II.

Flewwelling, P. 1995. An introduction to monitoring, control and surveillance for capture fisheries. FAO Fish. Tech. Pap. (338): 217 p.

Fortes, M.D. 1988. Mangrove and seagrass beds of East Asia: habitats under stress. Ambio 17(3): 207-213.

Fortes, M.D. 1995. Seagrasses of East Asia: environmental management perspectives. RCU/EAS Tech. Rep. Ser. No. 6.

Froese, R. and D. Pauly. 1996. FishBase 96: concepts, design and data sources. ICLARM, Manila. 179 p.

Gomez, E.D. 1988. Overview of environmental problems in the East Asian Seas region. Ambio 17(3): 166-169.

Gomez, E.D., F. Deocadiz, M. Hunspreugs, A.A. Jothy, K.J. Kuan, A. Soegiarto and R.S.S. Wu. 1990. State of the marine environment in the East Asian Seas region. UNEP Reg. Seas Rep. Stud. No. 126, 63 p.

Gulland, J. 1983. Fish stock assessment: a manual of basic methods. FAO/Wiley, New York. 223 p.

Hamley, J.M. 1975. Review of gillnet selectivity. J. Fish. Res. Board Can. 32(11): 1943-1969.

Hilborn, R. and C.J. Walters. 1992. Quantitative fisheries stock assessment: choice, dynamics and uncertainty. Chapman and Hall, New York. 570 p.

Holdgate, M., H. Kassas and G. White (eds.) 1982. The world environment, 1972-1982. UNEP Rep. Tycooly International, Dublin.

Holmgren, S. 1994. An environmental assessment of the Bay of Bengal region. Bay of Bengal Programme, Madras. BOBP/REP/67: 256 p.

Hotta, M. 1996. Regional review of the fisheries and aquaculture situation and outlook in South and Southeast Asia. FAO Fish. Circ. (904): 45 p. FAO, Rome.

Ingles. J. and D. Pauly. 1984. An atlas of the growth, mortality and recruitment of Philippine fishes. ICLARM Tech. Rep. 13, 127 p.

IPFC. 1987a. Papers presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia, Darwin, Australia, 16-19 February 1987. RAPA Rep. 1987/10: 552 p.

IPFC. 1987b. Report of the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia Darwin, Australia, 16-19 February 1987. RAPA Rep. 1987/9: 39 p.

Khoo, H.W , S. Selvanathan and H.A.M.S. Halidi. 1987. Capture fisheries, p. 89-109. *In* T.E. Chua, L.M. Chou and M.S.M. Sadorra (eds.) The coastal environmental profile of Brunei Darussalam: resource assessment and management issues. ICLARM Tech. Rep. 18, 193 p.

Koe, L.C.C. and M.A. Aziz. 1995. Regional programme of action on land-based activities affecting coastal and marine areas in the East Asian Seas. UNEP, Bangkok. RCU/EAS Tech. Rep.Ser. (5): 117 p.

Lawson, R. 1978. Incompatibilities and conflicts in fisheries planning in Southeast Asia. Southeast Asian J. Soc. Sci. 6(1-2): 115-136.

Lilburn, B. V. 1987. Formulation of fisheries management plans, p. 507-527. *In* IPFC. Papers presented at the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia, Darwin, Australia, 16-19 February 1987. RAPA Rep. 1987/10: 552 p.

Longhurst, A. and D. Pauly. 1987. Ecology of tropical oceans. Academic Press, New York. 407 p.

Marr, J.C. 1976. Fishery and resource management in Southeast Asia. RFF/PISFA Pap. 7, 62 p.

Marr, J.C. 1981. Southeast Asian marine fishery resources and fisheries, pp. 75-109. *In* L.S. Chia and C. MacAndrews (eds.) Southeast Asian seas: frontiers for development. McGraw-Hill, Singapore.

McManus, J.W. 1986. Depth zonation in a demersal fishery in the Samar Sea, Philippines, p. 483-486. *In* J. Maclean, L.B. Dizon and L.V. Hosillos (eds.) The First Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.

McManus, J.W. 1988. Coral reefs of the ASEAN region: status and management. Ambio 17(3): 189-193.

McManus, J.W. 1989. Zonation among demersal fishes in Southeast Asia: the southwest shelf of Indonesia, p. 1011-1022. *In* Proceedings of the Sixth Symposium On Coastal and Ocean Management/ASCE, 11-14 July 1989. Charleston, South Carolina.

McManus, J.W. 1996. Marine bottom fish communities from the Indian Ocean coast of Bali to mid-Sumatra, p. 91-101. *In* D. Pauly and P. Martosubroto (eds.) Baseline studies of biodiversity: the fish resources of Western Indonesia. ICLARM Stud. Rev. 23, 312 p.

Olver, C.U., B.J. Shuter and C.R. Minns. 1995. Towards a definition of conservation principles for fisheries management. Can. J. Fish. Aquat. Sci. 52: 1584-1594.

Pauly, D. 1979. Theory and management of tropical multispecies stocks: a review, with emphasis on the Southeast Asian demersal fisheries. ICLARM Stud. Rev. 1, 35 p.

Pauly, D. and G.I. Murphy. (Editors.). 1982. Theory and management of tropical fisheries. Proceedings of the ICLARM/CSIRO Workshop on the Theory and Management of Tropical Multispecies Stocks, 12-21 January 1981, Cronulla, Australia. ICLARM Conf. Proc. 9, 360 p.

Pauly, D. and T.E. Chua. 1988. The overfishing of marine resources: socioeconomic background in Southeast Asia. Ambio 17(3): 200-206.

Pauly, D. 1989. Fisheries resources management in Southeast Asia: why bother? p. 1-10. *In* T.E. Chua and D. Pauly (eds.) Coastal area management in Southeast Asia: policies, management strategies and case studies. ICLARM Conf. Proc. 19, 254 p.

Pauly, D. 1994. From managing fisheries to managing ecosystems. ICES, Copenhagen. ICES Inf. 24:7.

Pauly, D. 1995. Anecdotes and the shifting baseline syndrome of fisheries. Trends Ecol. Evol. 10 (10): 430.

Pauly, D. and P. Martosubroto. 1996. Baseline studies of biodiversity: the fish resources of Western Indonesia. ICLARM Stud. Rev. 23, 321 p.

Pauly, D. 1996a. Fleet-operational, economic, and cultural determinants of by-catch uses in Southeast Asia, p. 285-288. *In* Solving by-catch: considerations for today and tomorrow. Alaska Sea Grant College Prog. Rep. No. 96-03. University of Alaska, Fairbanks.

Pauly, D. 1996b. One hundred tons of fish and fisheries research. Fish. Res. 25(1): 25-38.

Pauly, D. 1997. Small-scale fisheries in the tropics: marginality. marginalization, and some implications for fisheries management. *In* E.K. Pikitch, D.D. Huppert and M.P. Sissenwine (eds.) Global trends: fisheries management. American Fisheries Society Symposium 20, Bethesda, Maryland.

Pope, J., A. Margetts, J. Hamley and E. Akjüz. 1975. Manual of methods for fish stock assessment, part III. Selectivity of fishing gear. FAO Tech. Pap. 41 (Rev. 1), 65 p.

Raja, B.T.A. 1980. Current knowledge of fisheries resources in the staff area of the Bay of Bengal. Bay of Bengal Programme, Madras. BOBP/WP8, 23 p.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board. Can. (191), 382 p.

Rothlisberg, P., D. Staples and B. Hill. 1988. Factors affecting recruitment in penaeid prawns in tropical Australia, p. 241-248. *In* A. Yañez-Arancibia and D. Pauly (eds.) IOC/FAO Workshop on Recruitment in Tropical Coastal Demersal Communities. IOC Works. Rep. No. 44.

Sainsbury, K. 1984. Optimum mesh size for tropical multispecies trawl fisheries. J. Cons. CIEM 41: 129-139.

Sardjono, I. 1980. Trawlers banned in Indonesia. ICLARM Newsl. 3(4): 3.

Sen Gupta, R., M. Ali, A.L. Bhuiyan, M.M. Hossain, P.M. Sivalingam, S. Subasinghe and N.M. Tirmizi. 1990. State of the marine environment in the South Asian Seas region. UNEP Reg. Seas Rep. Stud. No. 123.

Shindo, S. 1973. General review of the trawl fishery and the demersal fish stocks of the South China Sea. FAO Fish. Tech. Pap. 120, 49 p.

Silvestre, G.T., R.B. Regalado and D. Pauly. 1986. Status of Philippine demersal stocks - inferences from underutilized catch rate data, p. 47-96. *In* D. Pauly, J. Saeger and G. Silvestre (eds.) Resources, management and socio-economics of Philippine marine fisheries. Tech. Rep. Dep. Mar. Fish. 10, 217 p.

Silvestre, G.T. and D. Pauly. 1986. Estimate of yield and economic rent from Philippine demersal stocks, 1946-1984. Paper presented at the WESTPAC Symposium on Marine Science in the Western Pacific, Townsville, Australia, 1-6 December 1986.

Silvestre, G.T. 1990. Overexploitation of demersal stocks in Lingayen Gulf, Philippines, p. 973-876. *In* R. Hirano and I. Hanyu (eds.) The Second Asian Fisheries Forum, Asian Fisheries Society, Manila, Philippines.

Silvestre, G.T., M. Soriano and D. Pauly. 1991. Sigmoid selection and the Beverton and Holt yield equation. Asian Fish. Sci. (4): 85-98.

Silvestre, G.T. and H.J.H. Matdanan. 1992. Brunei Darussalam capture fisheries: A review of resources, exploitation and management, p. 1-38. *In* G. Silvestre, H.J.H. Matdanan, P.H.Y. Sharifuddin, M.W.R.N. De Silva and T.E. Chua (eds.) The coastal resources of Brunei Darussalam: status, utilization and management. ICLARM Conf. Proc. 34, 214 p.

Silvestre, G.T. 1995. Fisheries management and the selectivity of fishing operations. FAO Consultation of Experts and Industry on Selective Fishing for Responsible Exploitation of the Resources in Asia, Beijing, 12-17 October 1995. Inf. Pap. (12):25 p.

Silvestre, G.T. 1996. Integrated management of coastal fisheries: lessons from initiatives in San Miguel Bay, Philippines. ICLARM, Manila, 13 p.

Sivasubramaniam, K. 1985. Marine fishery resources of the Bay of Bengal. Bay of Bengal Programme, Madras, BOBP/WP/36:66 p.

Smith, I.R., D. Pauly and A.N. Mines. 1983. Small-scale fisheries of San Miguel Bay, Philippines: options for management and research. ICLARM Tech. Rep. 11, 80 p.

Soysa, C.H., L.S. Chia and W.L. Collier, (Editors.) 1982. Man, land and sea: coastal resource use and management in Asia and the Pacific. Agricultural Development Council, Bangkok, 320 p.

Staples, D. 1991. Penaeid prawn recruitment: geographic comparison of recruitment patterns within the Indo-West Pacific Region. Mem. Queensland Mus. 31:337-348.

Stephenson, R.L. and D.E. Lane. 1995. Fisheries management science: a plea for conceptual change. Can. J. Fish. Aquat. Sci. 52:2051-2056.

Thomson, D. 1988. The world's two marine fishing industries – how they compare. Naga, ICLARM Q. 11(3):17.

Tiews, K. (Editor.). 1973. Fisheries resources and their management in Southeast Asia. German Foundation for International Development. Federal Research Board for Fisheries and FAO, Berlin (West), 511 p.

Tolba, M. and O. El-Kholy, (Editors.). 1992. The world environment, 1972-1992. Two decades of challenge. Chapman and Hall for UNEP, London.

WCED. 1987. Our common future. World Commission for Environment and Development. Oxford University Press, Oxford.

Williams, M. 1996. The transition in the contribution of living aquatic resources to food security. Food, Agriculture, and the Environment Discussion Paper 13, 41 p. International Food Policy Research Institute, Washington, D.C.

Wilkinson, C.R., S. Sudara and L.M. Chou, Editors. 1994. Proceedings, Third ASEAN-Australia Symposium on Living Coastal Resources. Vol. 1: status reviews. Australian Institute of Marine Science, Townsville, Australia. 454 p.

WRI. 1995. People and the environment. WRI in collaboration with UNEP and UNDP.

Yanagawa, H. and P. Wongsanga. 1993. Review of fishery production, provisional estimation of potential yield and the situation of fisheries in the Southeast Asian region – 1976 to 1989. SEAFDEC Spec. Publ. (18), 114 p.

SECTION III

Fisheries Management, Policies and Tools

The Evolving Role of National Government Agencies in Coastal and Fisheries Management[1]

WILLIAM P. JATULAN
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

The role of national government agencies (NGAs) in strategic facets of coastal and fisheries management is indispensable. Successful programs having sufficient support from national and other assisting organizations (e.g., nongovernment organizations, academic institutions) are important for local governments and communities to manage coastal and fisheries resources effectively (DENR *et al.* 2001a).

While current coastal and fisheries management regimes are biased towards devolution and co-management approaches, giving ample influence and authority to local governments and local communities in implementing plans and programs, the role of NGAs remains essential especially in policy direction and technical guidance. Among the important NGAs having roles and responsibilities for coastal and fisheries management in the Philippines are the: Department of Environment and Natural Resources (DENR) and Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR). This paper examines their changing roles in the context of the Local Government Code (LGC), which paved the way for mainstreaming coastal and fisheries management in the Philippines.

Mandates and Functions of Government Agencies in Coastal and Fisheries Management

Department of Environment and Natural Resources

The role of DENR in coastal resource management (CRM) largely emanates from Executive Order (EO) 192, which reorganized the department in 1987 and provided a broad mandate and responsibility for the conservation, management, development and proper use of the country's environment and natural resources. This is supplemented by specific laws and administrative issuances that depict DENR's role in specific coastal management concerns such as for mangrove areas, marine pollution and environmental impact assessment system (Table 1).

Over the years, DENR initiated important policy and institutional reforms that consolidated its role in coastal management. Among these initiatives was the implementation of the Coastal Environment Program (CEP) in 1993 (DAO 19). Until 2001, the program had carried the functions of a cooperative activity ranging from resource inventory and assessment to actual project implementation by people's organizations in 78 sites across the country (DENR 2002).

In 2002, the Coastal and Marine Management Office (CMMO) was established via DAO 2002-08 to function as an interim administrative arrangement to ensure the efficiency and effectiveness of the department in the delivery of services pending approval of congressional initiatives to strengthen national government's programs in coastal management. CMMO is primarily tasked to coordinate and integrate all coastal management activities, specifically in policy review and formulation, coordination and integration of development and implementation of coastal programs and projects, and establishment and maintenance of coastal and marine information management system.

The shift from CEP to CMMO marked the change in focus and paradigm on the role of DENR in CRM, notably the support to devolution on LGU's mandate

[1] This paper can be cited as follows: JATULAN, W.P. 2004. The evolving role of national government agencies in coastal and fisheries management, p. 171-174. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 372 p.

Table 1. Policies that influenced DENR's role in coastal management (DENR *et al.* 2001b).

Year	Legislation[a]	Feature(s)
1974	PD 461	The Department of Agriculture and Natural Resources was divided into Department of Agriculture and Department of Natural Resources.
1975	PD 705	Releases to BFAR mangrove areas suitable for fishpond development; established mangrove areas needed for forest purposes.
1976	PD 979	The Marine Pollution Decree vested on DENR-Environment Management Bureau (EMB) the authority to promulgate laws governing marine pollution.
1978	PD 1586	The Philippine environmental impact assessment system was established under DENR.
1984	EO 967	BFAR was transferred from the Ministry of Natural Resources (MNR) to the Ministry of Agriculture and Food. However, jurisdictional authority over management of marine environment, including coral reefs and other marine habitats, remained with MNR.
1987	EO 192	DENR was mandated to exercise responsibility for the exploration and development of natural resources.
1992	RA 7586	NIPAS Law declared eight categories of protected areas, including protected seascapes under the administration of DENR-Protected Areas and Wildlife Bureau.
1992	DAO 30	Defined scope of devolved DENR functions to local government units (LGUs).
1993	DAO 19	Established the Coastal Environment Program (CEP).
1995	EO 263	Adopted and provided mechanisms for the implementation of the Community-based Forestry Management as the national strategy to ensure sustainable development of the country's forest lands/resources (including mangrove areas).
2000	Joint DA-DENR MOA No. 1	Delineated and defined functions and responsibilities of DA-BFAR and DENR in the implementation of the Fisheries Code.
2001	DAO 17[b]	Provided guidelines for the delineation and delimitation of municipal waters.
2002	DAO 8[c]	Aimed at strengthening CEP by establishing the Coastal and Marine Management Office (CMMO).

[a]DAO – Department Administrative Order; EO – Executive Order; MOA – Memorandum of Agreement; PD – Presidential Decree; and RA – Republic Act.
[b]Revoked by DAO 2003-07.
[c]CMMO is now a national program under the Undersecretary for Management and Technical Services.

n CRM (Table 2). Parallel units are now organized at the regional and community (Community Environment and Natural Resources Office [CENRO]) levels to respond to the technical needs of LGUs in their effective implementation of CRM plans and programs.

In 2003, CMMO regular operations commenced with the installation of operational mechanisms and staffing requirements. The CMMO logframe setting forth the technical assistance program for LGUs has been mainstreamed into the department's major final outputs, and specific targets have been spelled out for full-swing implementation. To date, about 595 staff have been designated to various CMM units, i.e., 121 coastal CENROs nationwide (except for the provinces of Marinduque, Romblon and Siquijor as no designates are named yet), 15 regional offices and central office (Table 3).

Department of Agriculture-Bureau of Fisheries and Aquatic Resources

As early as 1947, BFAR (then Bureau of Fisheries) has been the government institution primarily responsible for the regulation and management of all fishery resources of the Philippines. Succeeding legislation further defined the fisheries production and regulatory thrusts of the government, which were national in scope and character (DA-BFAR 1995) (Table 4). Under PD 704, the national policy on fisheries was to accelerate and promote the integrated development of fishery industry and maintain optimum production (Peña 1997).

The enactment of the LGC of 1991 and the Fisheries Code of 1998 further defined roles and responsibilities in coastal and fisheries management (Trinidad 1998). With respect to the coastal area largely encompassing the 15-km municipal waters, BFAR's mandate is now limited to technical assistance to LGUs in the development, management, regulation, conservation and protection of fisheries resource (Section 65, Fisheries Code of 1998). Beyond municipal waters, BFAR's role has been focused on management of commercial fisheries, including straddling and highly migratory fish stocks; maintenance of a monitoring, control and surveillance system; development and implementation of industry plans; and provision of extension services related to fish technology, marketing and development of value-added fishery products (ADB *et al.* 2003).

Table 2. Comparison of the salient features of CEP and CMMO.

Parameter	CEP	CMMO
Objectives	To implement programs and projects on conservation and management of Philippine environment.	To provide policy guidance, technical assistance and support information needs for CRM.
Rationale	Protection and proper management of coastal environments are important concerns, being the source of livelihood opportunities and food, and where majority of population resides.	Consolidation of DENR's role in CRM and strengthening of its organizational capacity to maintain sustainable development in coastal areas; enabling the department to assume leadership in setting national policy framework and to support LGUs.
Basic policy	Partnership with all sectors to protect, conserve and manage coastal environments. Integrity of coastal ecosystems and maximizing their productivity and biodiversity. Equitability of access to and utilization of resources and substantive involvement of local communities.	Devolution of coastal management functions. Use of precautionary approach in management of coastal and marine resources. Involvement of stakeholders in all stages of coastal and marine environment management planning. Multisectoral and multi-institutional collaboration intrinsic in coastal management. Maintenance of healthy and productive coastal and marine ecosystem as fundamental to management. Allocation of coastal and marine resources for long-term socioeconomic benefits.

Table 3. Staff distribution by Coastal and Marine Management unit.[a]

Region	No. of Staff				Regional
	Coastal CENROs	CMMS[b]	CMMD[c]	CMMO	Total
1	7	40	8	-	48
2	4	32	8	-	40
3	7	56	6	-	62
4a	8	39	8	-	47
4b	12	86	7	-	93
5	10	72	7	-	79
6	11	31	8	-	39
7	8	19	4	-	23
8	11	11	3	-	14
9	11	15	8	-	23
10	7	16	5	-	21
11	12	22	8	-	30
12	5	21	6	-	27
CARAGA	8	29	4	-	33
National Capital Region	-	-	9	-	9
CMMO (Central)	-	-	-	7	7
Grand Total	121	489	99	7	595

[a] Listing provided by CMMO as of January 2003.
[b] Coastal and Marine Management Section.
[c] Coastal and Marine Management Division.

Conclusion

Government agencies in coastal and fisheries management have evolved in response to changes in the policy environment and local needs. These changes have occurred in various modes and uneven pace. Technical assistance programs, such as DENR-United States Agency for International Development Coastal Resource Management Project and Asian Development Bank-BFAR Fisheries Resource Management Project have been facilitative of change especially that focusing on policy and institutional reforms. While such reforms are well underway, the attitudes of people affected by change leave much to be desired. There is this tendency of NGAs to resist further devolution by holding on or trying to regain command and control of functions and financial resources (Courtney *et al.* 2002).

The role of NGAs would remain significant in molding and harmonizing policies to enable local governments to effectively implement coastal and fisheries management programs. To date, while landmark fisheries-related legislations were passed,

Table 4. Key legislation that influenced BFAR's role in fisheries management (DENR *et al.* 2001b).

Year	Legislation	Feature(s)
1963	RA 3512	Created the Philippine Fisheries Commission.
1975	PD 704	BFAR's mandates included development and management of the country's fisheries.
1984	EO 967	Administration of BFAR was transferred from Department of Natural Resources (DNR) to Ministry of Agriculture and Fisheries (some functions, such as those related to the management of coastal and marine habitats remained with DNR).
1986	EO 116	BFAR was relegated to the food production group of DA and became a staff bureau. BFAR's administrative, regulatory and enforcement functions and field units were abolished.
1987	EO 292	Both DA and DENR were assigned fisheries-related functions.
1991	RA 7160	Specific fishery management functions (regulatory and enforcement) were devolved to LGUs.
1997	RA 8435	Agriculture and Fisheries Modernization Act.
1998	RA 8550	BFAR was reconstituted as a line bureau of DA.

there is still an absence of a formal institutional arrangement for a single national agency to coordinate coastal management. From the policy and institutional standpoint, current mandates of DENR and DA-BFAR tend to separate fisheries from coastal ecosystem. Several bureaus of DENR have, in one way or another, contributed to coastal management implementation. DA-BFAR rightly so, considers fisheries management within the realm of its expertise. But, glaringly missing in these assertions is the absence of a national coordinating agency that puts into proper perspective various initiatives into one consistent and coherent program and policy for the Philippine coastal zone.

Local governments would continue to rely on NGAs for technical guidance so much so that their initiatives are consistent with the national policy and coastal and fisheries management framework. Over the last 10 years, LGUs, by virtue of being project beneficiaries, or out of their own initiative, received technical assistance and capability-building programs from various service providers, NGOs and donor-assisted programs. These somehow fill the vacuum that LGUs want to satisfy, that is, to discharge their coastal management mandate enshrined in LGC.

References

ADB (Asian Development Bank), GEF (Global Environment Facility) and DENR (Department of Environment and Natural Resources). 2003. Integrated Coastal Resource Management Project Final Report. Prepared by Tetra Tech EMI and PRIMEX Inc., Pasig City, Philippines.

Courtney, C.A., A.T. White and E.T. Deguit. 2002. Building Philippine local government capacity for coastal resource management. Coast. Manage. 30 (1): 27-45.

DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). 1995. Fisheries Administrative Orders (a compilation). Fisheries Sector Program, Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001a. Philippine coastal management guidebook no. 1: Coastal management orientation and overview. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines. 58 p.

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001b. Philippine coastal management guidebook no. 2: Legal and jurisdictional framework for coastal management. Coastal Resource Management Project of DENR, Cebu City, Philippines. 170 p.

DENR (Department of Environment and Natural Resources). 2002. Coastal and Marine Management Office Regional Orientation Workshop for Regional Planning Officers and Chiefs of Coastal and Marine Management Division. DENR, Quezon City, Philippines.

Peña, N. 1997. Philippine law on natural resources. Rex Book Store, Quezon City, Philippines.

Trinidad, A.C. 1998. The Fisheries Code of 1998: Something old...something new...something better? Tambuli 4: 17-24.

Equitable Access and Preferential Use of Municipal Waters by Municipal Fisherfolk[1]

JENEEN R. GARCIA
Environmental Legal Assistance Center
354-P Betty Lu Compound
Queens Road, Cebu City
Philippines

Introduction

At first glance, "equitable access" and "preferential use" seem to contradict each other. The seas, after all, are there for anyone to enter equally—how can preferring one sector over all other sectors make access to marine resources more equitable for everyone?

The long history of use—and depletion—of Philippine marine resources has proven that increasing fisheries production does not necessarily mean more food on the table of fisherfolk families. Ironically, it can even mean greater poverty for small-scale fishers. Fortunately, the government has realized that those who have less in life must have more in law. The following discussion traces how the national policy on marine resource use has evolved from an open access regime to the beginnings of true community-based resource management (CBRM).


J. Garcia

Dried fish is often a source of income for small-scale fishers.

Fish is Where the Money is

Fisheries used to be a domestic matter. Pre-Hispanic barangays had exclusive rights to their traditional fishing grounds (La Viña 1999). But when Spanish rule "transferred" ownership of all resources to the state through the 1866 Spanish Law of Waters, the country's fisheries became open to all. Anything under the sea was fair game for whoever was willing to invest time, effort and money into it. On the other hand, no laws to ensure sustainable yield or equitable distribution were passed by the government to manifest its "ownership". As a result, uncontrolled exploitation of fisheries resources continued during the Spanish and American periods, with nobody being held legally liable for the decline in fish stocks.

Only the threat of Japanese encroachment moved the government to finally pass a Fisheries Law in 1932, restricting commercial fishing activities to American and Filipino-owned corporations. For the first time, municipal waters were defined as up to 5.5 km from shore; municipal governments now had authority to grant licenses to commercial fishers within these waters. Despite imposing these limitations, the Commonwealth and succeeding governments were still bent on increasing fish production by granting more fishing licenses and encouraging more efficient technology (La Viña 1999).

Effectively then, whoever had the capital based on this policy controlled the country's fisheries. Usually, capital came from wealthy lawmakers themselves, many of whom worked with foreign investors (La Viña 1999). The sea and its bounties,

[1] This paper can be cited as follows: GARCIA, J.R. 2004. Equitable access and preferential use of municipal waters by municipal fisherfolk, p. 175-179. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

previously thought to be equally open for use by all, turned out to be exclusive to a preferred sector due to existing policies and unequal distribution of capital.

The Descent to Poverty

With the introduction of the best technology this kind of capital could buy, and with the innumerable fishers wanting to get as much fish as they could, not only were the open seas efficiently overfished, most of the ecosystems that supported fisheries—mangroves, seagrass beds and coral reefs—were destroyed as well.

Traditional fisheries management could no longer compensate for the leaps in technological efficiency and the demands of a large-scale, international market (Johannes 2002). Small-scale fishers, already poor to begin with, could not hope to acquire the technology or tap markets that could earn them the same profits as commercial fishers.

Steadily, the contribution of municipal fisheries to the national yield decreased as commercial fisheries accelerated (Lacanilao 1998). Whereas small-scale fisheries production exceeded commercial fisheries production by 150% in the early 1950s, the contribution of the small-scale sector dropped to only 30% by 1996 (Cruz-Trinidad *et al.* 2002).

Household incomes of fisherfolk across the country were pushed below the poverty line. In 1996, 80% of fisherfolk households were living in poverty (PRIMEX 1996). Commercial and municipal fishers still plied the same seas and exerted the same effort, but commercial fishers simply had bigger nets. Small-scale fishers, no longer reaping the benefits from their traditional fishing grounds, were essentially being eased out of their waters. Hard-pressed to earn a living, many fisherfolk devoted all efforts and what capital they had to farming or deep-sea fishing. They consequently had no interest or spare time and money for coastal resource management (CRM) education or meaningful participation in the governance of their resources. Some resorted to destructive fishing methods in fishing grounds elsewhere because their traditional fishing grounds were already incapable of producing enough fish (Figure 1).

Illegal fishing practices and the lack of CRM initiatives further degraded the marine ecosystem, which in a vicious cycle worsened poverty in every household (ELAC 2002). In 1996, even the commercial fish catch decreased, indicating that overfishing and

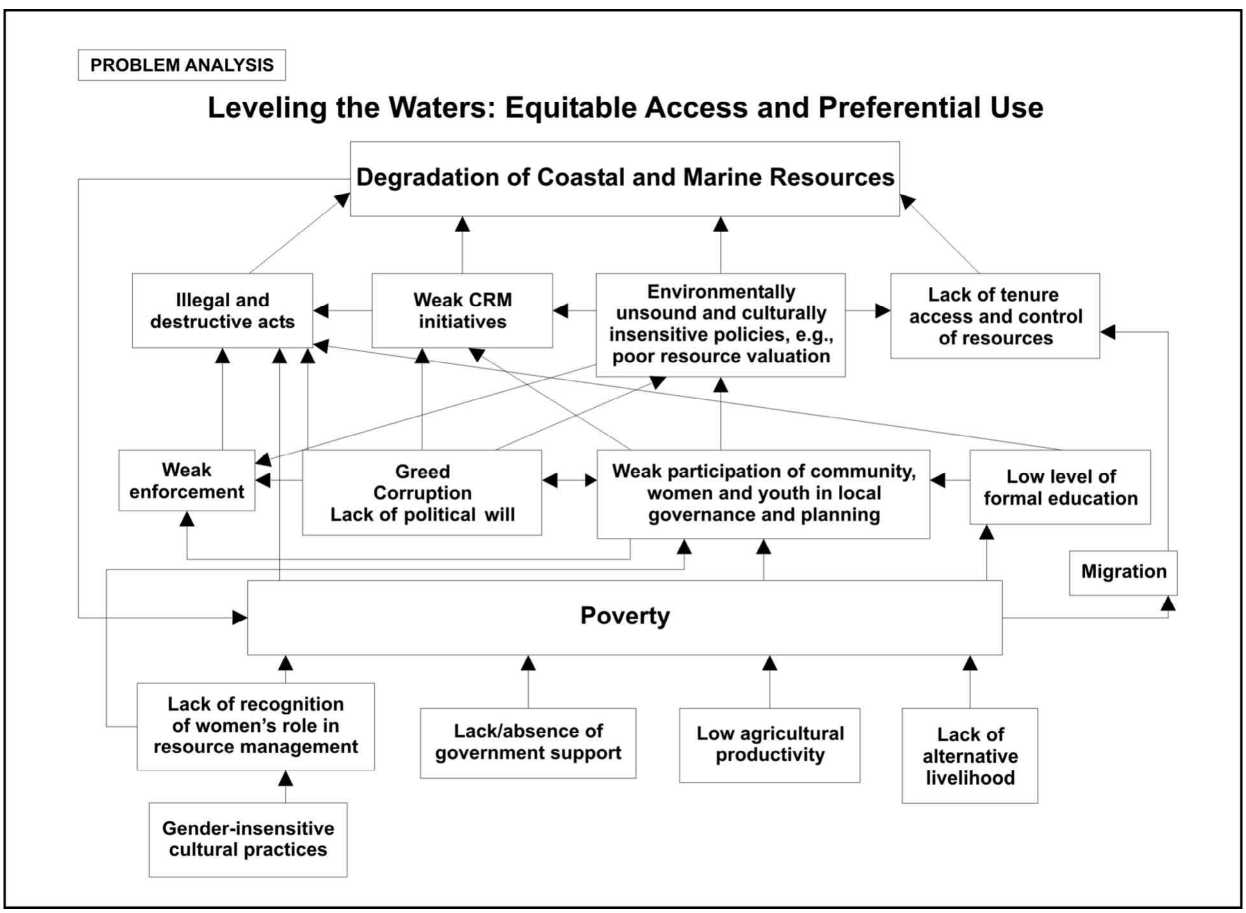


Figure 1. ELAC CBRM problem analysis.

damaged coastal habitats had finally taken their toll (Lacanilao 1998).

Getting to the Bottom of It

Because of centralized resource management, the state had failed to protect a great majority of its people against poverty. Open access to fishery resources had given an unfair advantage to the wealthy, thereby depriving fisherfolk of their right to food security and use of the resource they depended on for food.

Social justice dictated that the masses, instead of a minority, benefit most from the country's resources. Fisheries had to be harvested at a rate and volume that would ensure a continuing supply of food for both present and future generations. Fisherfolk communities, long marginalized by the law and the fishing industry, were now seen as the saviors of the country's coastal resources, and CBRM became the official strategy. The rationale for CBRM is not only moral, but practical as well. Coastal communities are bound not merely by family or geographical ties but more by a shared interest in a common resource. Whatever happens to their resource base, whether positive or negative, can mean feast or famine for them. Most commercial fishers can easily move from one rich fishing ground to the next or, if no viable fishing ground remains, simply invest in another enterprise (Lacanilao 1998). Municipal fisherfolk, having less mobility and capital, must deal with the consequences of marine degradation.

The Law Comes Through

The 1987 Philippine Constitution, Article XIII, Section 7, says that the government "shall protect the rights of subsistence fishermen, especially of local communities, to the preferential use of the communal marine and fishing resources, both inland and offshore. It shall provide support to such fishermen through appropriate technology and research . . . and other services." Embodying this policy are the Local Government Code and the 1998 Fisheries Code.

Working with the principle that organized communities are the best managers of their own resources, the Local Government Code assigns municipal governments the responsibility of creating and implementing guidelines for local fisheries. Article 149 of this Code grants "duly registered organizations and cooperatives of marginal fishermen preferential right to fishery privileges . . . " It also sets the municipal waters at 15 km from the shoreline.

The Fisheries Code, taking this a step further, declares as a policy the right of municipal fisherfolk to preferential use of municipal waters. By giving exclusive fishing rights to local residents in municipal waters at least 10 km from shore, it somewhat levels the playing field between small-scale and commercial fishers. The law also provides various options for limiting access to the fishery including those in the municipal sector (Box 1).

The 1998 Fisheries Code is also considered a breakthrough in fisheries legislation because it "returns" the management of municipal waters from national to local governments. Organized community members are given the opportunity to formally participate in management efforts through, among

Box 1. Modes of Access Limitations as Provided for by the 1998 Fisheries Code

The fishing license and permit system is mandated to be based on the limits of maximum sustainable yield (MSY), with preference in allocation being given to resource users of local communities in adjacent or nearest municipal waters. Catch ceiling limitations are intended to limit access through restrictions on the harvesting of resources. Users of municipal waters are also intended to be largely limited to residents of the city or municipality to which the municipal waters pertain, as seen in the requirement for the establishment of a registry of municipal fisherfolk. Priority is given to resident fisherfolk and/or their cooperatives and organizations in the granting of demarcated fishery privileges in municipal waters. Fishery activities may also be limited or prohibited in overfished areas. Commercial fishing vessels are also generally prohibited from fishing within municipal waters, unless specifically authorized to do so by the LGU concerned.

The establishment of closed seasons and closed areas, as well as fish refuges and sanctuaries, is another mode of limiting access (temporal and spatial). The municipal government, in consultation with the FARMC, has jurisdiction over the establishment of closed seasons and closed areas within municipal waters, while the BFAR, with the concurrence and approval of the affected LGU and FARMC, may do so in waters beyond the municipal boundaries.

User fees and other fishery charges are based on resource rent. This concept considers social benefits from using the fishery as a resource, over and above financial profits of users. By considering only the latter, there is a tendency to expand fishing effort (both labor and capital) to levels at which society is suffering a net loss. Other procedures recognized as limiting access include the limited entry of both commercial and municipal fishing vessels in areas deemed as overfished by either the DA or relevant LGU. Another is the absolute prohibition on the use of active (e.g., trawl, purse seine, Danish seine, and bag net) fishing gear in municipal waters; and that of fishing beyond the total allowable catch or fishing during closed seasons.

Source: DENR *et al.* (2001).

others, the Fisheries and Aquatic Resources Management Councils (FARMCs).

Legal instruments, such as the Certificate of Ancestral Domain Title and Mangrove Stewardship Contracts, now also exist to give coastal communities a semblance of tenurial security. These instruments likewise encourage communities to take charge of resource management planning and implementation. Tenurial rights are imperative in ensuring that fisherfolk communities obtain permanent, exclusive rights over the resources in a specific area, that fickle politics or legislation will not eventually deprive them of the long-term benefits of their management efforts (Quicho *et al.* 1999).

Working at Ground Level

However, the benefits of enlightened legislation are sometimes hardly felt because of poor implementation. Lack of government support, sometimes with government officials themselves breaking the laws, has proved to be detrimental to the community's will to manage their resources. The government's political will to enforce fisheries laws is crucial in sustaining the community's morale in asserting their territorial and resource use rights.

Fortunately, nongovernment organizations (NGOs) and people's organizations (POs) step in to help communities assert these rights by first enhancing indigenous knowledge and practices in resource management. Information and education programs instill a conservation ethic where there is none yet, and build the community's confidence in their ability to manage their own resources. Once socially prepared, the organized community goes through a process of assessing their resources and current situation, determining the causes of their resource problems and identifying the best ways to deal with these problems. Collective participation and learning gives the community a greater sense of ownership for the identified interventions, making members more likely to implement these.

NGOs and POs, being based in the communities, have also taken the cudgels for the "preferential access" granted to municipal fishers by assisting in the delineation of municipal waters and the apprehension of coastal law violators. Community-based law enforcement is the most effective way to protect municipal resources while lightening the load of understaffed and underfunded government agencies (Lacanilao 1998).

Feed Only Hunger

With the help of current policies and implementing institutions, equitable access and preferential use are gradually becoming not only principles or provisions in the law, but also realities enjoyed by municipal fisherfolk. However, any system has room for improvement. To ensure food security and long-term protection of community rights, legislative interventions must be based on scientific assessments and not just on economic benefits, even if communities are intended to share in the gain. For example, Quicho *et al.* (1999) suggested that tenurial instruments be based not just on traditional territories defined by the community, but also on ecological—instead of political—boundaries. Commercial fishing licenses must be issued not just on the basis of revenue needs, but more importantly on the local fishery's carrying capacity. Given that fishing pressure has to be decreased, social justice and science still dictate that municipal fisherfolk be given the opportunity to fill the market's need for fish instead of commercial fishers.

The importance of territorial rights, CRM education and government support cannot be underestimated. A study by Hickey and Johannes (2002) of resource management initiatives in the island state of Vanuatu revealed that because fishing grounds belonged to "indigenous custom owners and their descendants" instead of to the state, the fisheries harvest was equitably distributed and fishing efforts spread out. More importantly, the effectiveness of initiatives introduced could easily be perceived and therefore sustained by the community. CRM initiatives proposed by the government through an education campaign caught on quickly among the villages once some communities discovered how effective they were. When resource use or territorial conflicts arose, the government would withhold support for the initiatives, leading the communities to create effective dispute resolution processes.

In the end, the principles of equitable access and preferential use bring back fisheries management to a domestic level. They reflect a deeper, traditional attitude towards fisheries: that of respect for the sea as giver of life. Though Johannes (2002) said that indigenous cultures only developed a conservation ethic when they had depleted their own resources, it is still arguable that traditional Philippine societies conserved the country's rich resources not because they were running out of food, but because they took only what they needed. Only with the unfair competition posed by upper class individuals, many of whom are backed by foreign interests, did environmental degradation accelerate to the point of national poverty. As Juan Flavier wrote: “Hunger did not kill them. Greed did.”

References

DENR/DA-BFAR/DILG (Department of Environment and Natural Resources, Department of Agriculture-Bureau of Fisheries and Aquatic Resources and Department of the Interior and Local Government). 2001. Philippine coastal management guidebook no. 2: Legal and jurisdictional framework for coastal management. Coastal Resource Management Project of DENR, Cebu City, Philippines. 170 p.

ELAC (Environmental Legal Assistance Center). 2002. ELAC draft CBRM framework. Process documentation of the ELAC CBRM Writeshop, 20-23 November 2002, Cebu City, Philippines.

Green, S.J., A.T. White, J.O. Flores, M.F. Carreon III and A.E. Sia. 2003. Philippine fisheries in crisis: A framework for management. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines. 77 p.

Hickey, F.R. and R.E. Johannes. 2002. Recent evolution of village-based marine resource management in Vanuatu. SPC Trad. Mar. Resour. Manage. Knowl. Inf. Bull. (14 October): 8-21.

Johannes, R.E. 2002. Did indigenous conservation ethics exist? SPC Trad. Mar. Resour. Manage. Knowl. Inf. Bull. (14 October): 3-7.

Lacanilao, F. 1998. State of Philippine coastal fisheries: Keynote address at Food Security and Fishery Resources, 10 December 1998. National Research Council of the Philippines, Quezon City, Philippines.

La Viña, A.G.M. 1999. Management of fisheries, coastal resources and the coastal environment in the Philippines: Policy, legal and institutional framework. Policy, Legal Inst. Stud. Work. Pap. No. 5. International Center for Living Aquatic Resources Management and Swedish International Development Agency.

PRIMEX (Pacific Rim Innovation and Management Exponents, Inc.). 1996. Fisheries Sector Development Project, Philippines (ADB TA No. 2236-PHI). Phase I Report. Vol. II: Fisheries Sector Program review. (Unpublished).

Quicho, R.F.N. Jr., G.T. Mislang and A.S.P. Batay-an. 1999. Access to resources in coastal waters for municipal fisherfolk. Paper presented at Pangisdaan ni Juan: A Forum on Access to Resources in Coastal Areas, 11 November 1999. University of the Philippines College of Law, Quezon City, Philippines.

Local Governance for Municipal Fisheries: Can Local Governments Afford to Have Coastal Resource Management as a Basic Service Responsibility?[1]

ROSE-LIZA V. EISMA
Coastal Conservation and Education Foundation, Inc.
PDI Condominium, Banilad, Cebu City
Philippines

Introduction

The devolution of powers to local government units (LGUs) reinforced opportunities for local level planning and implementation of coastal resource management (CRM) programs. Prior to the enactment of the Local Government Code (LGC), resource management programs and action plans typically originated from national government agencies, with the support of scientific and academic institutions that generated the technical information base for management strategies (DENR *et al.* 2001). At present, LGUs play a pivotal role in CRM, having been given more duties, responsibilities and accountabilities for management of coastal resources within municipal waters. Although CRM is not legally defined, many of the activities encompassed by it are found, both implicitly and explicitly, in major policies. Some LGU-based activities, which are the main CRM processes, include enactment of ordinances, adoption of CRM plans, enforcement, technical assistance, training, information-education campaigns, database management, and setting up of monitoring and evaluation systems.

Sources and Uses of Funds

Adequate resources are essential for these expanded coastal management responsibilities. Funding for CRM is available from two sources: government and nongovernment. Government sources for most LGUs can come from local taxes, fees, licenses and charges and also from national sources, such as internal revenue allotments (IRA) and share in the proceeds of national wealth. With LGUs having greater fiscal autonomy, revenues can be generated from internal sources, such as taxes, incomes, fees and charges. The LGC, under Section 186 thereof, provides that LGUs may exercise the power to levy taxes, fees or charges through an ordinance which is enacted after public hearings are conducted for the purpose.

Each LGU also gets annual shares in IRA which are determined on the basis of collections from national internal revenue taxes actually realized. The total annual IRA shares due all LGUs are allocated according to provinces (23%), cities (23%), municipalities (34%) and barangays (20%). In addition, LGUs can receive about 40% of the national revenue as their equitable share in proceeds derived from utilization and development of national wealth within their respective territories based on Section 289 of LGC.

It is apparent that CRM monies can be tapped by LGUs from different sources. They can impose taxes or even enter into memoranda of agreement with outside nongovernment organizations (NGOs) to help their CRM programs. However, concerns have been raised on whether these available funds are actually being used by LGUs to finance CRM. For CRM functions, LGUs can create their own sources of revenue by virtue of LGC and the Philippine Fisheries Code. Section 149 of the Fisheries Code lists down the following fisheries-related functions that can generate revenues for LGUs:

[1] This paper can be cited as follows: EISMA, R.V. 2004. Local governance for municipal fisheries: Can local governments afford to have coastal resource management as a basic service responsibility?, p. 180-183. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

- fishery privileges to erect fish corrals and oyster, mussel or other aquatic beds;
- bangus fry concessions;
- licenses for operation of fishing vessels of 3 GT or less;
- licenses for operation of small and medium-scale fishing vessels within 10.1 to 15 km area;
- permits for operation of pearl farms; and
- auxiliary invoices for transfer of fish and fishery products.

LGU Funding: Not Always Enough

Despite all these available funding sources, many LGUs still feel that they are unable to pay for the additional obligation of managing their 15-km municipal waters. For most LGUs, CRM is still an underfunded mandate. In a 1997 survey of coastal mayors, 75% identified inadequate funding for coastal management as a key constraint (DENR, n.d.). While LGUs may impose taxes or fees for the use of municipal waters, many are still hampered with the lack of legitimacy and political will to collect from this tax base, thus, making the principal revenue source coming from their share of IRA.

Presently, the share of each province, city and municipality in IRA is based on land area (25%), population (50%) and equal sharing (25%) (Section 285, LGC). The formula for computation of IRA does not include the area of municipal waters, hence, most LGUs think that it does not reflect the true extent of responsibilities of coastal municipalities.

A coastal municipality has to take on significant basic service responsibilities and costs compared to noncoastal communities. For CRM plans to be carried out, incremental costs are attached to these. CRM activities that need to be implemented include establishment of marine reserves, law enforcement, rehabilitation of mangroves, setting up of environment-friendly enterprises in coastal areas, and such others. To achieve the estimated annual budgetary requirements for CRM programs, LGUs need approximately P1-1.3 million annually to begin and maintain the process (White and Cruz-Trinidad 1998). A more detailed costing for CRM programs for a six-year period (including one year for investment) estimates P1.4 million for investment and a recurring cost of P400,000-600,000 per year for a period of five years (Table 1). The bulk of investment costs is accounted for by boat purchase (which was noted to be a cost that can be shared with other LGUs), an office and some capital equipment (vehicles, computer, global positioning system units, etc.). Most of the recurring cost is accounted for by staff costs; the rest are small budget items, such as meetings, trainings and maintenance of equipment. Possible cost-sharing with other LGUs (like in the case of the boat) and performance of regular LGU functions such as consultations and public hearings can significantly bring down costs.

Based on their present share in IRA, LGUs are unable to meet the needed budget for CRM. Lack of funding poses serious implications for key CRM programs. Without the needed funds, LGUs are forced to reduce personnel and to abandon local programs and activities. Indeed the need for CRM funding cannot be overemphasized. To address this, LGUs also have to rely on other sources.

Most LGUs are facing so many local problems with more devolved functions and less support from national agencies. Hence, programs aimed at CRM are often not a priority of LGUs. In some instances, priorities for implementing these programs are also dependent on the will of local officials. This becomes possible because of increasing fiscal autonomy where LGUs can decide on how to utilize their local funds. For instance, the use of the Development Fund is merely subject to minimum requirements. Under Section 384 of the Implementing Rules of the LGC, it shall only be mandatory for LGUs to set aside in its annual budget amounting to no less than 20% of its IRA for the year as appropriation for local development projects. However, the condition neither specifies the kind of development project nor requires CRM as part of local development projects.

Political differences between local chief executives and legislative bodies also become a major stumbling block for prioritization of CRM programs. Furthermore, there is lack of awareness by LGUs on how to utilize available and existing funding for CRM, such as, but not limited to, Environmental Guarantee Fund of private companies, Community-based Resource Management Project, and the like. Finally, local revenue generation is often hampered by degraded habitats within the locality.

Strategies to Increase Funding for CRM

The coastal and marine resources in the country are in near crisis condition. CRM is necessary to achieve national goals for food security from these resources. One way of achieving this is by ensuring the delivery of CRM as a basic service of local governments. When CRM becomes a basic mandate of LGUs, there will be proper basis for appropriating funds and imposing taxes, licenses and fees. At present, coastal LGUs are

Table 1. Investment and operating costs associated with CRM process (Trinidad 2000).

CRM Benchmarks and LGU Activities	**Investment Cost Year 0**	**Operating Costs - Year**				
		1	**2**	**3**	**4**	**5**
Step 1. Setting up the municipal CRM office						
a. Staff						
b. Capital outlay	70,000	250,000	275,000	302,000	332,750	366,025
c. Maintenance and operations		10,000	10,000	10,000	10,000	10,000
Step 2. Issue identification						
a. Program preparation, staffing and development of workplan	20,000					
b. Participatory coastal resource assessment	10,000					
c. Mapping of municipal water boundaries	10,000					
Step 3. CRM plan preparation and adoption						
a. Fisheries and Aquatic Resources Management Councils established and active	5,000	2,500	2,500	2,500	2,500	2,500
b. Multisectoral technical working group established	5,000	2,500	2,500	2,500	2,500	2,500
c. Water use zones delineated and mapped	10,000					
d. Multi-year CRM plan drafted, finalized and adopted	5,000	10,000	10,000	10,000	10,000	10,000
e. Database development	50,000	10,000	10,000	10,000	10,000	10,000
Step 4. Action plan and project implementation						
Legislation						
a. Ordinances enacted for CRM plan regulation	0					
Regulation						
a. Registry of municipal fisherfolk established	5,000	1,000	1,000	1,000	1,000	1,000
b. Permits and licenses issued	10,000					
Law enforcement						
a. Coastal law enforcement units trained and operational	20,000	60,000	60,000	60,000	60,000	60,000
b. Purchase and maintenance of boats	500,000	25,000	25,000	25,000	25,000	25,000
c. Ordinances enforced	0	0	0	0	0	0
d. Violators prosecuted	0	0	0	0	0	0
e. Best practices[a] implemented		50,000	50,000	50,000	50,000	50,000
Step 5. Monitoring and evaluation (M&E)						
a. M&E team trained	20,000					
b. Environment and ICM process monitored and fedback to database and plan		10,000	10,000	10,000	10,000	10,000
c. Performance evaluations conducted						
d. Management capacity assessment conducted		10,000	10,000	10,000	10,000	10,000
e. Outcome evaluations conducted						
Step 6. Information, education and outreach						
a. Annual CRM status reports and maps produced						
b. Information management system functional and institutionalized						
c. Information disseminated						
d. Technical assistance and outreach program established						
Others	690,000	20,000	15,000	10,500	35,000	35,000
Total	**1,430,000**	**461,000**	**481,000**	**503,500**	**558,750**	**592,025**

[a] CRM best practices include: (i) setting up and maintaining sanctuaries and other protected areas; (ii) having a fully functioning FARMC; (iii) placing mangroves under community-based forest agreements; (iv) making the *Bantay Dagat* or other enforcement groups operational; and (v) setting up environment-friendly enterprises.

hampered by funding to have CRM as a basic service responsibility. Hence, it is but timely to find schemes for the inclusion of the CRM mandate and funding for all coastal LGUs.

A list of recommendations was discussed by the Program and Policy Advocacy Group (PPAG)[2] during the Sixth Policy Forum on Estimation of Incremental Cost for CRM in Coastal Municipalities. The PPAG is a formal gathering of select individuals from national government agencies (NGAs), NGOs, people's organizations, academe and other coastal stakeholders. The list of funding mechanisms is as follows:

A. Amend specific provisions of LGC to make CRM a basic service similar to health, agriculture, etc. These provisions include:
   - Section 17 - to expressly state therein that CRM is a basic service of coastal LGUs;
   - Section 484 - to make "mandatory" municipal and provincial Environment and Natural Resource Officers;
   - Section 284 - to expand responsibilities of municipal and provincial Environment and Natural Resource Offices to include CRM; and
   - Section 291 - to highlight LGUs' share in national wealth from coastal and marine resources.

B. Include municipal waters in the computation for sharing in IRA.

C. Develop guidelines for use of the Environmental Guarantee Fund to include CRM.

D. Appropriate special funds for CRM programs of LGUs in the General Appropriations Act.

E. Review and revise guidelines to include use of the 20% Development Fund for CRM. Also, LGUs must be encouraged to increase their share of local sources of revenues and mandatorily allocate a portion for CRM activities.

F. Expand the menu of projects in the Rural-Urban Development Fund to include CRM through a Presidential Instruction.

G. Include, through an amendment, CRM as a priority area in coming up with the Annual Investment Plans as provided for in Executive Order 189 (dated 21 December 1999) and Local Budget Circular No. 70 (dated 14 March 2000).

H. Legislate through an ordinance a special assessment tax or fee for a local CRM fund similar to the Special Education Fund as collected via the real property tax.

The private sector as a source of funds

LGUs can also rely upon financial inputs of the private actors and NGOs to carry out their CRM programs. Outside actors can also augment the domestic funding source. They often fund a great deal of CRM activities and provide technical assistance to local officials and law enforcement equipment, such as patrol boats, radios and even honoraria for *Bantay Dagat* members. Major foreign agencies, e.g., USAID, United Nations Development Programme, Global Environment Facility, etc., also serve as external funding sources. These bilateral and multilateral development assistance packages are usually distributed through various NGAs.

References

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001. Philippine coastal management guidebook no. 2: Legal and jurisdictional framework for coastal management. Coastal Resource Management Project of DENR, Cebu City, Philippines. 170 p.

DENR (Department of Environment and Natural Resources). n.d. Proposed national coastal resource management policy for the Philippines. (Unpublished).

Trinidad, A.C. 2000. Cost and benefits of CRM as LGU intervention. Paper presented at the Sixth Policy Forum, Program and Policy Advocacy Group, 18-19 July 2000, Dumaguete City, Philippines.

White, A. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines. 96 p.

[2] The Policy Forum was sponsored by Silliman University's Center of Excellence in Coastal Resource Management and Coastal Resource Management Project, both funded by the United States Agency for International Development (USAID).

The Changing Role of Local Governments: Bohol Provincial Government and Fisheries Management[1]

NUNILA M. PINAT
Bohol Environment Management Office
Office of the Governor, Province of Bohol
Philippines

STUART J. GREEN
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

Bohol is the first province in the Philippines to proactively utilize the existing policy and legal framework for coastal resource management (CRM). It is promoting CRM through the provision of technical assistance to its component municipalities. This is promising for Bohol, which counts over 80,000 full-time fishers. It is also strategic for the whole country, given that Bohol covers a huge 6,245 km^2 of municipal waters and has a shoreline of over 650 km (Green *et al.* 2002). It is also an area renowned for falling catches, overharvested fisheries, damaged reefs and illegal fishing activities.

Bohol lies in the heart of Central Visayas, geopolitically known as Region VII, along with the provinces of Cebu, Siquijor and Negros Oriental (Figure 1). Bohol is the 10th largest province of the Philippines and is composed of 48 municipalities of which 30 are coastal. The province has 367 coastal villages with a population of close to 1.2 million (NSO 2002). Fish provides more than 50% of the animal protein of the province.

Fish catch in the province has decreased considerably in the last few years being roughly 5% of what it was in the 1950s (Figure 2). The decline is due to a larger number of fishers using more efficient fishing gear (mostly newly introduced types of net) and catching smaller fish . Certain species of fish have almost completely disappeared. This is the experience in Cogtong Bay on the east of Bohol, named after the large groupers found in the area in years past, that can no longer be found in the bay.

The fishers most affected are those fishing within 1-3 km offshore, especially the hook-and-line fishers using nonmotorized boats that target demersal fishes. The inshore habitats are, on the whole, degraded with most mangrove areas having been converted (roughly 5,000 ha) to fishponds during the last three decades. In a series of studies done in the province on the status of living coral, none were found to be in excellent condition. Only 14% sampled were in good condition, while fair and poor states of the habitat were found in 38% and 48% of areas sampled, respectively. This meant that over 75% of Bohol's living coral cover was only in a poor to fair state and explains some of the reduction in fish catch (Green *et al.* 2002).

As set forth in the Local Government Code (LGC) of 1991 (Republic Act 7160), the responsibility for managing coastal resources in the Philippines was largely devolved to local governments, mainly cities and municipalities. The LGC devolved the basic powers and authorities to local governments in planning, environmental protection, legislation,

[1] This paper can be cited as follows: PINAT, N.M. and S.J. GREEN. 2004. The changing role of local governments: Bohol provincial government and fisheries management, p. 184-188. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

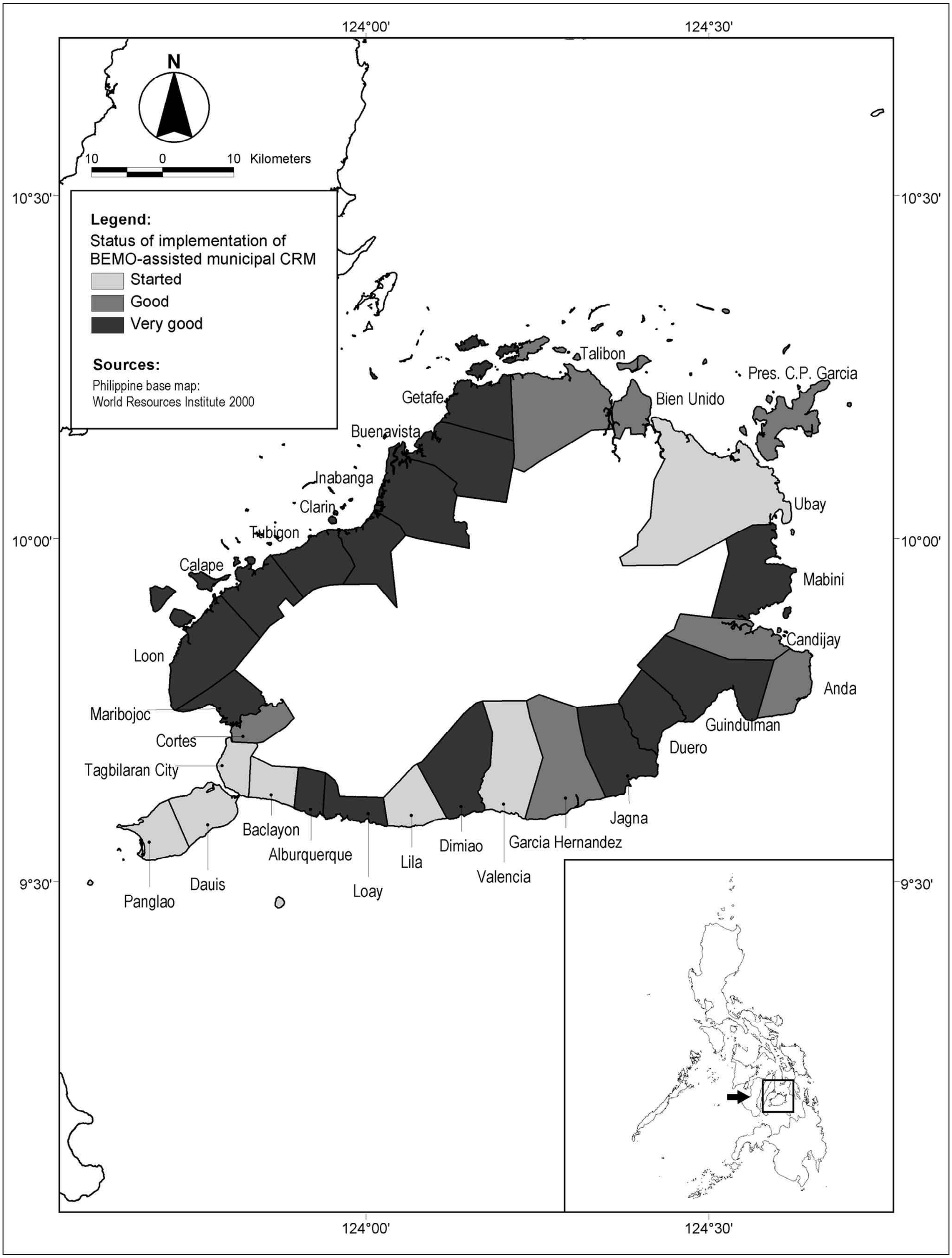


Figure 1. Location map of Bohol Province, Philippines, showing status of BEMO-assisted CRM implementation in the various municipalities.

regulation, enforcement, extension services, intergovernmental relations, and relations with people's organizations and nongovernment organizations (NGOs). Most municipalities were not able to assume these "devolved" CRM functions instantly as they were more focused on other activities, such as establishing the required administrative and financial systems (Courtney *et al.* 2000). Also, the technical capacity in CRM was not readily available.

The Experience of Bohol

The province has had some major environmental problems, notably illegal quarrying of its famous Chocolate Hills and the plan to sell water to Cebu City. The quarrying resulted in one less hill but, nevertheless, the experience saw their most famous tourism asset and number one pride desecrated. Likewise, the sale of water was estimated to provide significant economic benefits, but another loss for the Boholanon psyche. Add to this sand mining, habitat destruction, pollution and depleted fishery resources. After these initial issues, there was a severe backlash from many sectors that something had to be done before the province just ended up looking and being another Cebu Province.

In 1997, Bohol, in coordination with the Governance and Local Democracy Project and CRMP of the Department of Environment and Natural Resources and a variety of other institutions decided to hold a Bohol-wide Environment Summit. The aims of this summit were to get together the different stakeholders to assess the current environmental situation in Bohol and agree on strategies to halt the creeping degradation and ensure environmental security. The summit was a success with over 1,000 representatives of key stakeholders of the province attending. The outputs were consolidated into the "Bohol Covenant for Sustainable Development". Another key output of the summit was the demand from different stakeholders for legislation, that laid out a framework on how the provincial government would implement its covenant.

After further refinement and consultation, the provincial government approved the Bohol Environment Code (BEC) (Provincial Ordinance No. 1, Series of 1998), which laid out the key responsibilities of the province in maintaining ecological balance and an implementation "road map". One of the key features

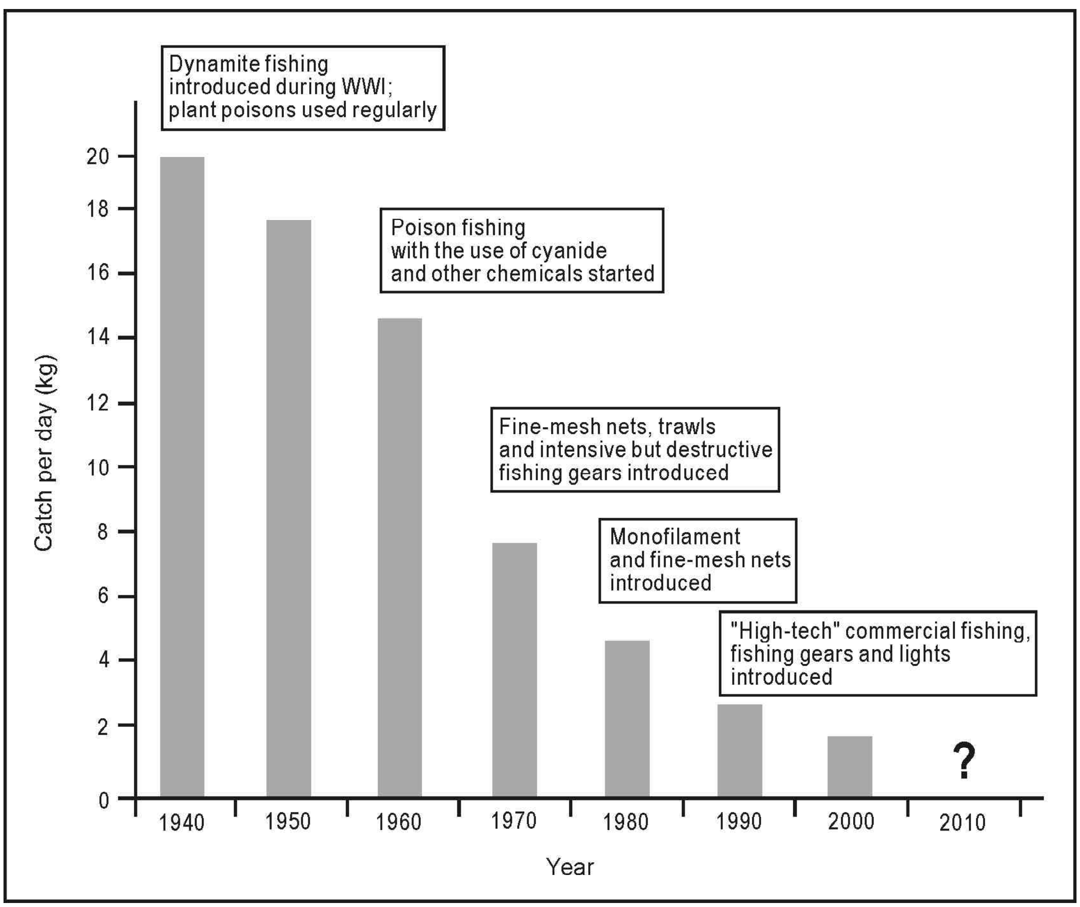


Figure 2. Declining fish catch of marginal fishers.

Table 1. Key milestones of BEMO since its establishment.

Year	Milestones
1998	• Bohol Environment Code legislated • Established BEMO with 3 staff and a minimal budget • Established initial CRM learning areas with CRMP in Northwest Bohol (7 LGUs)
1999	• Established CRM resource center and pool of trainers within the province, trained in all basic CRM courses from mangrove management to CRM planning and MPA establishment as well as others • Established quick response unit to initiate a speedy response to urgent problems
2000	• Established expansion CRM learning areas in eastern and southern Bohol (8 LGUs) • Established a Provincial Natural Resources Database, upon which to base planning and coastal management interventions • Conducted the Bohol Coastal Law Enforcement Summit with over 500 stakeholders from law enforcement agencies, judges, fisherfolk and commercial fishers to explore coastal law enforcement problems in the province and develop a remedy
2001	• Established second batch of expansion learning areas (8 LGUs) • Developed clear CRM implementing framework and benchmarks for the province • Presented and validated the framework and benchmarks for the province with all coastal NGOs, NGAs and LGUs to converge efforts in CRM • Purchased and launched three mother patrol boats and established multi-agency coastal law enforcement teams and councils per coastal district
2002	• Provincial Government awarded ISO 14001 for its environmental management • Over 30 staff now working in various environment sectors; 8 are full-time, focusing on CRM
2003	• BEMO CRM section now present in all coastal LGUs of the province • Over 95 MPAs established • Over 2,500 ha of mangrove placed under Community-based Forestry Management Agreements • Over 50% of coastal LGUs with legislated and budgeted five-year CRM plans • Over one-third of the province have officially delineated municipal waters

of BEC was the establishment of a Provincial Environment Management Office, later to be called the Bohol Environment Management Office (BEMO), which has nine key sectors, one of which is CRM. The CRM section was created and formalized through a Memorandum of Agreement involving CRMP (Yambao *et al.* 2001). BEMO's main mandate is to capacitate municipalities in offering integrated coastal management (ICM) as a basic service, similar to health and education. The CRM section of BEMO began offering technical assistance to municipal governments in the basic CRM planning process, starting from participatory coastal resource assessment to planning and the development of five-year plans. Once plans were established, models of best practices at the village level, for mangrove management, marine protected areas and fisheries management were initiated. The status of BEMO-assisted CRM implementation across the various municipalities in the province is summarized in Figure 1.

The province, having a bird's eyeview of things, developed a niche that could push ICM to a higher level. The province identified key geographical areas that required CRM; key hotspot areas for illegal fishing; and coral and mangrove management which needed concerted effort among local government units (LGUs), more resources and an integrative approach.

The BEMO set itself up as more of a "learning institution", catalyst and information processor focusing on capacitating LGUs and sharing lessons of CRM implementation. It also became an "institutional memory" which could take a longer-term view than municipalities which undergo changes in politicians and programs. In terms of networking and resources, it was also able to help direct, modify and push for external institutions to focus on a province-wide approach and to share the variety of external funding and programs around the province fairly and equally. Of an estimated P70 million (Green *et al.* 2002) being spent in the province per year on ICM-related activities, after the intervention of BEMO and the governor, the resources were directed away from the traditional focus of North and West Bohol to cover the whole of the province's 30 coastal municipalities[2]. The BEMO's province-wide perspective paved the way for nurturing small CRM projects around the province to bloom and expand to larger geographic

[2] With over 15 NGOs working in the province and various programs funded by the World Bank and others, and after a provincial workshop, new priority areas for CRM were identified. Donors and NGOs were encouraged to move to East and South Bohol.

areas and move into a more "ecosystem", inter-LGU and fisheries management approach.

Table 1 shows the key milestones of BEMO since its establishment and indicates that the province is taking a key leadership role in ICM. If enabled through legislation, and human and financial resources, it has great potential to be the key technical assistance provider for fisheries and environmental management. It can provide guidance and direction to NGOs, national government agencies, people's organizations and LGUs in implementing a collaborative CRM across the province. This has in turn proved lucrative for the province, attracting a variety of agencies and donor groups interested in sparking a relationship with the provincial government. Counterparting and a common framework and direction are the keys to this, with BEMO building on its institutional memory of what works and does not work in CRM in the province.

Key Lessons

Following are the key lessons in the experience of Bohol in its role in fisheries management:

- It is important to have an agency or group which can help focus on a wider area management approach, within provinces or by districts, to encourage a larger ecosystem approach.
- Having a provincial "learning institution" which can share, build on and develop key lessons around a simple CRM framework, will ensure that implementation will improve as each CRM project cycle is passed and that the lessons are fed directly into other ongoing projects.
- Having a provincial government pushing for CRM interventions gives substantial peer pressure on key institutions working in CRM and helps focus limited human and financial resources to where they are needed.
- The provincial government has a huge mandate and potential role in fisheries management, despite this being somewhat unspecified in LGC. It is up to key political leaders to pick up the mandate and move to implementation.

References

Courtney, C., A.T. White and E. Deguit. 2000. Building Philippine local government capacity for CRM. Coast. Manage. 30: 27-45.

Green, S.J., R.D. Alexander, A.M. Gulayan, C.C. Migrino III, J. Jarantilla-Paler and C.A. Courtney. 2002. Bohol Island: Its coastal environmental profile. Bohol Environment Management Office, Bohol, and Coastal Resource Management Project, Cebu City, Philippines. 174 p.

NSO (National Statistics Office). 2002. Population census for the Province of Bohol. NSO, Philippines.

Yambao, A, E. Deguit and A.T. White. 2001. Provincial CRM: Bohol, Masbate and Davao del Sur forge ahead. Tambuli 7: 1, 4-14.

The Philippine Tuna Industry Gets Organized[1]

STANLEY N. SWERDLOFF
USAID Growth with Equity in Mindanao Project
Aldwinco Commercial Bldg. 7, Ladislawa Garden Village
Buhangin, Davao City
Philippines

Introduction

The Philippine tuna industry is an important element in the country's economy, contributing over 100,000 direct jobs and US$180 million in foreign exchange earnings (Swerdloff 2002). Prior to 1999, the industry was poorly organized, with a handful of special-purpose associations, only sporadic contact with government agencies and no real policy agenda. This all changed with the advent of the South Cotobato, Sultan Kudarat, Sarangani and General Santos (SOCSKSARGEN) Federation of Fishing Associations and Allied Industries (SFFAAI) in August 1999. The organization of SFFAAI was a focal point of the fisheries component of the Growth with Equity in Mindanao (GEM) Project of the United States Agency for International Development.

The Federation

The SFFAAI initially brought together six tuna fishing associations representing both traditional handline and sophisticated purse seine fishing technologies. The purse seine vessels use large nets to catch skipjack and juvenile yellowfin tuna, while the handline fishers use simple hook-and-line fishing to catch large yellowfin and bigeye tuna. In 2000, the federation was joined by the General Santos City tuna canners and the fresh-frozen sashimi processors. The federation now consists of 8 associations representing over 200 fishing and processing companies with approximately 2,800 fishing and service boats. It represents close to 30,000 fishers and 11,000 processing workers.

The main mandate of the federation is to unite the diverse subsectors of the tuna industry, serve as a forum to discuss problems and how to resolve them, and to be the key voice of the local tuna fishery in lobbying for policy reforms and other concerns that affect the industry. With new lines of communication open between fishers and processors, the industry is developing long-term strategies to remain competitive in the world market.


USAID-GEM

Yellowfin tuna ready for sale at General Santos City market.

During the 1999-2000 international tuna industry crisis, when record tuna catches caused ex-vessel prices to plummet below breakeven levels, the SFFAAI hosted two regional workshops to discuss the causes and solutions to the problem. These were followed by a National Tuna Forum, co-hosted by the Department of Agriculture (DA)-Bureau of Fisheries and Aquatic Resources (BFAR), in which all segments of the industry gathered to develop a strategy for alleviating the crisis. SFFAAI commissioned a "Rapid assessment of the Philippines tuna industry" (Dy 1999) and drafted a strategic plan for the sector. The federation strategies include:

- Philippine participation in the process of developing regional tuna management;
- support of sustainable fishing practices;
- legal access to fishing grounds of neighboring countries;

[1] This paper can be cited as follows: SWERDLOFF, S.N. 2004. The Philippine tuna industry gets organized, p. 189-191. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

- removal of European Union tariff barriers on canned tuna;
- rationalization of pumpboat registration procedures; and
- solutions for frozen sashimi US patent and regulatory issues.

Key outputs

With a firm strategy in hand, the federation then sponsored a National Tuna Congress in late 1999, which attracted over 300 participants from associated industries (fishing, processing, banking, suppliers) and government agencies. This event laid the groundwork for a coordinated effort by private sector and government to address the fundamental problems of the tuna industry. With these positive results, the federation subsequently hosted three more National Tuna Congresses in 2000-2002.

SFFAAI has lobbied for strong Philippine participation in regional fisheries management, legitimate fishing access agreements with neighboring countries and regulation of domestic tuna fisheries. It has clearly been successful in changing the attitude of the tuna industry with regard to long-term sustainability of the resource and cooperative undertakings within the region. For example, the federation supports the Multilateral High Level Convention on Management and Conservation (MHLC) of Migratory Species in the Western and Central Pacific. MHLC held 7 sessions between 1995 and 2000, with official participation by 27 countries and territories, including all of the major tuna fishing states and Pacific Island countries. The objective of MHLC was to develop a regional commission that would manage the highly migratory resources (mainly tuna) in the international waters of the tropical Pacific. As a regional management regime was put in place, each coastal state was expected to adopt compatible regulations for its exclusive economic zones. The Philippines sent two observers to the first two MHLC sessions, but they were not able to actively participate.

When the federation learned of the importance of MHLC, it briefed its members and BFAR on the potential impact of the proposed regional commission on the Philippine fishing sector. This initiative led to active participation by large Philippine delegations at the succeeding five sessions. Strong inputs from the federation convinced the Department of Foreign Affairs (DFA) that MHLC was an important undertaking, and DFA responded by naming senior diplomats to head the delegation.

Key issues

Prior to each MHLC session, the industry and BFAR/DFA met to discuss upcoming issues and to develop Philippine positions (the issue / position papers were prepared by the federation, with technical assistance provided by GEM program). With this coordinated effort, the Philippines was able to win important concessions in the final convention text. For example, several large fishing countries wanted to ban transshipment of fish at sea because this practice was advantageous to the Philippine fleet, but impractical for other fleets. The Philippines managed to counter the arguments and avoid the ban. Another issue was the demand of the island countries that all vessels fishing on the high seas should use satellite monitoring equipment, and accommodate observers from the commission. While this is fine for large purse seine vessels, it is impractical for the 2,500 Philippine small boats using hook-and-line fishing. The Philippines was able to insert a language that exempts the more “traditional” craft and their fishers from these requirements.

Achievements

Noting its satisfaction with the convention text, the Philippines became a signatory in September 2000. In terms of fisheries management, the MHLC Convention is a powerful tool for assuring sustainable fisheries. The text requires all participating countries to adopt management regulations that are compatible with strict MHLC standards. Thus, the Philippine government, as a responsible signatory, must revise its fisheries regulations to include sustainable fishing practices. In fact, BFAR is currently reviewing and revising regulations to comply with MHLC standards. The tuna industry, recognizing that it will lose fishing rights in the Pacific if it does not abide by the new regulations, has become a strong supporter of MHLC. In fact, the industry encouraged the government to host one of the MHLC Preparatory Conferences, and this resulted in the country hosting the Third MHLC Preparatory Conference in November 2002. The federation, along with Manila colleagues, worked hand-in-hand with BFAR to plan and implement the highly successful conference. The regional commission is expected to begin operations in 2003 following ratification by at least 13 countries, and DFA has prepared documents for ratification by the Philippine Senate.

Bigeye tuna being offloaded from a carrier, for marketing, General Santos City.

In addition to MHLC, the tuna industry is working closely with DFA and DA to participate in a United Nations-sponsored initiative to combat illegal, unreported and unregulated fishing. This new initiative, in conjunction with MHLC, will improve registration and data reporting of the commercial fleet, and bolster the Philippine image as a responsible player in international fisheries.

In its efforts to gain legitimate access to neighboring countries, SFFAAI has urged DFA and BFAR to negotiate bilateral fisheries agreements. The first agreement, setting terms and conditions for fishing access, was finalized with Indonesia in 2001 and is now in force. A Memorandum of Understanding for Fisheries Cooperation has been finalized with Palau and signing will take place in mid-2003.

In the trade arena, SFFAAI sparked an effort by DTI to reduce canned tuna tariff barriers in the European Union. This cooperative undertaking by government and industry has resulted in a reduction of tariff from 24% to 12%, a tremendous competitive boost for the Philippine tuna industry.

The federation has also successfully lobbied for revisions in the Maritime Industry Authority and BFAR regulations affecting tuna handline boats, and is currently seeking amendment to the Fisheries Code to assure proper registration of all commercial fishing boats.

Internally, the federation has undertaken a number of technical workshops for its members, including improvement of fish quality, longline fishing methods, bioeconomics of net mesh size, and alternative handline fishing techniques.

Growth

After viewing the success of the SOCSKSARGEN Federation, tuna industry players from Manila, Visayas and Zamboanga sought organizational expansion to the national level. This resulted in the formation of the Philippines Confederation of Tuna Industries in 2000, which brought together virtually all tuna fishing and processing elements in the country.

The national confederation has now become the central voice of the tuna industry. One of the first actions of the confederation was to request the formation of a joint government-industry body to coordinate policies and strategies in support of the tuna industry. The DA responded by forming, through Special Order, the National Tuna Council, with ten representatives from industry and officials from five government agencies. The council has become the all-important interface between government and industry.

The national confederation entered the international arena when it hosted two organizational meetings of tuna purse seine vessel owners from Asia, the Americas and Europe. This effort resulted in the formation of the World Tuna Purse Seine Owners Association in early 2001. For the first time in history, the major tuna fishing fleets of the world are working together to rationalize the catch of this international favorite.

What started as an effort to increase communication at the local level has now resulted in a national structure that influences the world of tuna.

References

Dy, R. 1999. A rapid assessment of the Philippines tuna industry. University of Asia and the Pacific, Pasig City, Philippines.

Swerdloff, S. 2002. Summary report: USAID- Growth with Equity in Mindanao. Louis Berger Group, Davao City, Philippines.

Information Management Systems for Philippine Fisheries[1]

MARCIANO F. CARREON III
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

Philippine fisheries are characterized by declining productivity. This can be most effectively solved, as noted throughout much of this book, by the reduction of fishing effort. It is very likely, given the number of fishers, that reduction of effort will result in the direct displacement of many people. Considering the dependency of millions of Filipinos on this resource, any decision made to reduce effort will be subjected to considerable question and opposition, and ultimately will be difficult to implement. As such, it is necessary to back decisionmakers, among others, with information that are timely, accessible and as accurate as possible. This scenario is but one of several potential uses and values of a decision support system, or in this case, an information management system (IMS) for fisheries and coastal resources.

It is essential that data are gathered, analyzed, stored and distributed within an information system so they can be utilized in an efficient and effective manner. Consequently, managing fisheries in such a manner requires development and use of fisheries IMS (DENR *et al.* 2001).

Information Use in Fisheries: Applications in Development and Protection of Resources

The characterization of physical, biological, social and economic aspects of fisheries intrinsically requires the generation and use of data. This characterization is used in the formulation of plans and the implementation of actions under these plans. Processed data or information are central to how fisheries resources are managed. The sensitive and dynamic nature of fisheries, i.e., the existence of a host of external factors that randomly and continuously act on fisheries, requires a demanding level of the quality and precision of data.

There are a host of data sets from various sources that are used singularly or in conjunction with one another in undertaking measurements to provide estimates of the health, scope, characteristics, limitations and potentials of a given fishery. The more traditional data sets in fisheries are fish production data, collected at a regular frequency, usually gathered at designated landing sites, and for the most part broken down into species or larger taxonomic groups. Also collected at landing sites are length-weight frequency data. There are also test or experimental fishing data sets, and fish visual identification for underwater investigations. These are just examples of a plethora of data sets or databases that are quite specific to fish stocks. Beyond this are the spatial or geographic, oceanographic and ecological and even the demographics-related data that equally need to be generated and analyzed to draw a picture of what is happening in the fisheries and consequently support decisions in fisheries and coastal resource management (CRM).

The investments required in making the data available, and to gain capacities and undertake actions to use these are sizeable. To date, the capacity to generate and use data in fisheries in the Philippines is very limited. While data are being collected and analyzed, these are often for site-specific areas under particular project support. Such data may contribute to plans for these management areas of concern and are used to formulate policy and make decisions locally. But, such information are not yet collected at a national level to make consistent decisions about actions needed

[1] This paper can be cited as follows: CARREON, M.F. III. 2004. Information management systems for Philippine fisheries, p. 192-196. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

to address specific fisheries concerns. Thus, we have not yet made clear links between information and national fisheries management actions, except for specific and small areas in the country.

Systemic and Institutional Issues in Fisheries Information Management

Developing a culture of information use in planning

While detailed information on fisheries may be limited, there exists a number of studies on the state of fisheries in selected areas. Mostly sourced from assessments undertaken in projects, these information provide indicators on the state of a fishery and should be sufficient basis to draw up mitigating measures to address evident problems and issues. The culture of using information in fisheries management has yet to be established. A constant practice that almost singularly prevented the development of such a culture, particularly with government, is that of planning based on budgets and on political programs that go under recycled and refurbished slogans. The need for and utility of information is contingent on the intent to manage fisheries. Only when managing fisheries is established as a priority, will information be generated properly and consistently for this end.

Establishment of information management units in institutions

The establishment of an IMS, particularly the generation and processing of data can be costly. With the potential range of databases used in managing fisheries, it makes sense that this be organized in a systematic manner. An IMS for fisheries databases is a basic tool in the pursuit of establishing the use of information in managing fisheries. Such a system allows for easier access, quick retrieval and cross referencing of data sets both horizontally and vertically within government and among research institutions.

The development of this system, data flow designs and processing should parallel the physical structure of the user organization or the structure of linkages among user organizations. Within the user organization are points or nodes of information utility. It is necessary to establish units within these nodes to handle data flows, minor processing and act as repositories of data sets immediately needed by users within the node. The establishment of the structure and units requires systems and subsystems development, equipment and training of personnel.

Formulation and implementation of data gathering regime for fisheries management

The development of an information system in the Bureau of Fisheries and Aquatic Resources (BFAR) is currently underway through the Fisheries Information Management Center (FIMC) under the Fisheries Resource Management Project (FRMP). The system, referred to as PhilFIS or the Philippine Fisheries Information System, is already in its final stages of development and deployment. There are a number of project-based resource databases under the system as well as bibliographic and map databases. The system is also composed of databases that require updating almost on a real-time basis (Table 1). To make the latter databases functional, there

Table 1. Databases and information contained in the PhilFIS system.

Database	Contents Description
Catch and effort	Information on key fishing gears and their CPUE over time for key areas in the country
Map	Maps in the country using a geographic information system and base maps for most of the country
Resource and ecological assessments	Documents and primary information on the results of the FRMP-initiated baywide resource and ecological assessments in various bays and coastal areas in the country
Socioeconomic assessment	Documents and primary information on the results of the FRMP-initiated socioeconomic assessments
Documents	Fisheries and coastal management related documents in the country
Bibliographic collections	Bibliographies pertaining to the country's fisheries sector, stored electronically
Licensing and violations	Fisheries-related violations and licensing information in the country
Fisherfolk information system	Fisherfolk information from around the country
Philippine fish fauna checklist	The country's identified fish fauna
Data synchronization and systems management	Data and systems management for PhilFIS

Box 1. The National Stock Assessment Program

NOEL BARUT
Bureau of Fisheries and Aquatic Resources
Department of Agriculture, Quezon City
Philippines

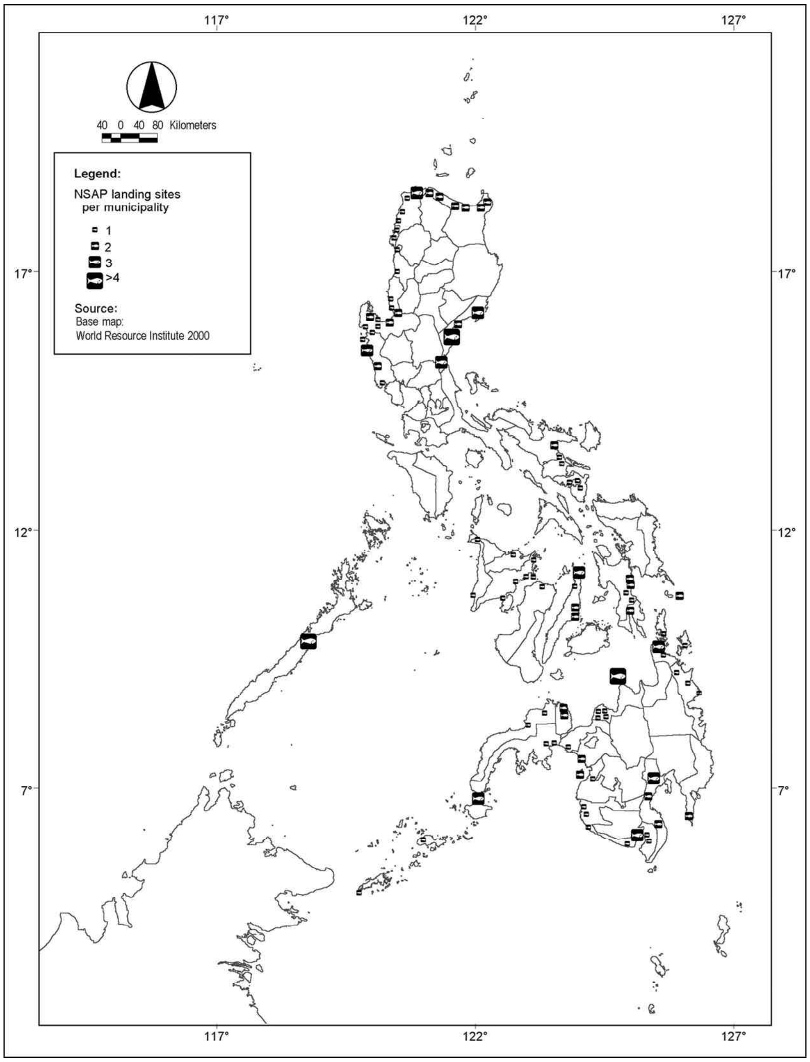


Figure 1. Geographic coverage of the National Stock Assessment Program of BFAR.

The National Stock Assessment Program (NSAP) was designed to institutionalize stock assessment so that continuous and reliable time series data will be available for the development of sound fisheries management strategies. The program aims to train and equip regional technical staff of the Bureau of Fisheries and Aquatic Resources (BFAR) regional offices in stock assessment and to put together various assessments being conducted in the Philippines under one umbrella.

Pursuant to Sections 7, 8 and 9 of Republic Act (RA) 8550 or the Fisheries Code of 1998, stock assessment should be conducted to provide the basis for management options. Stock assessments are necessary for the determination of maximum sustainable yield, total allowable catch, closed seasons and the number of commercial fishing vessel licenses to be issued, among others, as provided by RA 8550.

Trained enumerators hired by the project collect catch, effort and length frequency data in selected major and minor landing sites in 15 political regions of the country (see Figure 1). In selected monitoring stations, other biological data such as sex and maturity, gut content and fecundity are also collected. Sampling in all sites follows the procedures contained in the sampling manual developed by the project.

Data collected at the monitoring stations are encoded into a database, which is connected to the BFAR central office through an intranet system. Processing, analyses and interpretation of data are done in the regional offices with technical assistance from the central office, the University of the Philippines College of Fisheries and other institutions with expertise in stock assessment. Thus far, information generated by the project has been used by some local government units in formulating municipal ordinances to conserve and manage their marine fisheries resources. The NSAP also provides catch data to the Bureau of Agricultural Statistics, which includes these in the national fisheries statistics.

is a need to input data continuously. This data gathering initiative is currently limited to a few sites and selected species under the National Stock Assessment Program (NSAP) of BFAR (Box 1).

There is also the Municipal Coastal Database (MCD) developed by the Coastal Resource Management Project (CRMP) of the Department of Environment and Natural Resources. The MCD was developed primarily as a tool for municipal and city governments to manage strategic information and data on the status of coastal resources and implementation of CRM activities as performed by LGUs. The MCD is managed and utilized at four levels: municipal/city, provincial, national and regional. Each level has its distinct MCD installation CDs, reports, and management and maintenance requirements. The municipality is the primary user of MCD and the responsible government unit for managing it. Information and data are entered only at this level. Information requirements for MCD and types of responses are illustrated in Table 2. The provincial unit is the next responsible party for MCD consolidation and management. It imports municipal/city MCD datafiles and generates provincial reports. The DENR Regional Coastal and Marine Management Division is responsible for consolidating all provincial level MCDs and generates regional reports. The DENR Coastal and Marine Management Office is responsible for consolidating all regional MCD datafiles to maintain a nationwide MCD.

Standards, linkages and compatibility

There exist a number of databases and information systems that have been developed or are usable for fisheries. These include: PhilFIS (see www.frmp.org/philfis2), Knowledge-based, Decision Support and Adaptive System for CRM and Sustainable Offshore Fisheries Development Project (KDACS, see www.upv.edu.ph/kdacs), FishBase (see www.fishbase.org), Fisheries Resource Information System and Tools (FIRST, see www.worldfishcenter.org/trawl), ReefBase (see www.reefbase.org), Aquatic Resources Management Information System (ARMIS), and Agriculture and Fisheries Research and Development Information System (AFRDIS, see www.bar.gov.ph/afrdis.htm).

In July 2002, the University of the Philippines - College of Fisheries in Miagao, Iloilo, sponsored the First Consultative Meeting on Knowledge Management for Philippine Fisheries. The objectives of the meeting were to inform partners on updates regarding fisheries database and information

Table 2. Examples of typical datafields of DENR-CRMP MCD (DENR-CMMO 2000).

Datafield	Basic Description of Fields Requiring a Response
General information	Classification, location, province, total number of barangays (coastal and noncoastal), population, land area, municipal water area, office responsible for CRM
Local government unit (LGU) budget	CRM allocations, number of staff hired, CRM-related revenue
CRM organizations	Municipal Fisheries and Aquatic Resources Management Council, *Bantay Dagat* and rating for how active/inactive the organizations are
CRM planning	Coastal profile, planning and assessments conducted, ordinance adopting the plan
CRM and fisheries-related legislation passed by the *Sanggunian*	List of all ordinances and resolutions related to coastal management
Coastal resource/habitat status	Area and relative condition of each prime habitat, corals, seagrasses, mangroves, etc.
Municipal fisheries	Municipal production, average CPUE
Coastal law enforcement	Fish warden/s' activities, patrolling operations, apprehensions, cases filed and convictions
Incidence of illegal activities	Destructive fishing, commercial fishing intrusion, illegal cutting of mangroves, illegal shoreline development
Marine protected areas (MPAs)	Name of MPA, area, ordinance, fish abundance, living coral cover
Mangrove management	Organization, area, year initiated, number of members
Environment-friendly enterprise development	Location, attributes, people involved, effectivity of enterprise
CRM-related trainings	List of trainings conducted and partners working in the municipality

systems and to establish modes of communication, leading to and promoting the development of knowledge management infrastructure for Philippine fisheries. The development of the infrastructure primarily deals with the issue of compatibility of these systems with the goal of developing a fisheries database interface or other forms of linkage that may maximize utility of these systems as depicted in Figure 2. The initiative is a first step to make these interfaces functional and compatible.

Considerations for Future Information Management Initiatives in Fisheries

The development of IMS for Philippine fisheries has been influenced by a number of factors, not necessarily based on a good understanding of the need for such systems. The development has been driven by a simple notion that one should have it because other countries have it. Also the evolving use of computer technology has influenced IMS development, often in a direction that makes its use impractical, especially by regional and provincial fisheries offices without adequate computer facilities or training.

This is the case with several of the current national databases, resulting in poor utilization of these systems and subsequently in difficulties in generating resources for upgrades and maintenance. An observation now being accepted is that computerization of a system that has no roots from a manual system is very likely to fail in terms of functionality and sustainability. Basically, this simply says that if there was no effort to establish a manual system first and test it, there may not be any rationale in putting up a computerized one.

Information has to be generated, processed and managed for specific practical and essential purposes. Thus, an IMS in fisheries makes sense only if it is used to manage fisheries. This simple axiom is not yet being followed and is why most attempts at establishing a fisheries IMS have failed. While there are existing efforts in fisheries IMS, most of these have yet to realize its full utility. A more likely scenario for success is the establishment of a limited fisheries management regime in pilot areas and the development of a fisheries IMS as a component of that limited regime. This may be the more simple approach to establishing the roots of fisheries management and functional information systems in this country. It will have to be tailored to needs and capacity of government institutions that will make it function.

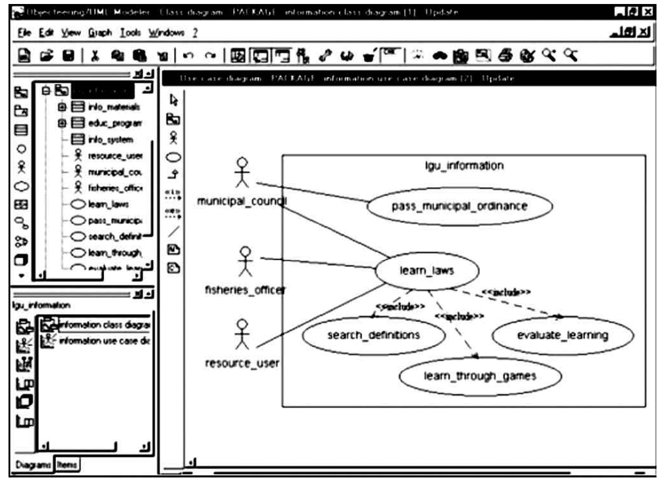


Figure 2. UML Modeler, a software that was used to develop KDACS; the window shown represents how user requirements were gathered in the KDACS design phase.

The need to make sound decisions in fisheries management is ever more critical in view of the worsening state of fisheries. Sound decisions can only be made if done in an informed manner. It is then expected that there will be an improved emphasis on the use of fisheries information and IMS in this country in the near future. The information systems enumerated herein may also see their full utilization as a result of this predicament.

References

DENR-CMMO (Department of Environment and Natural Resources - Coastal and Marine Management Office). 2000. Municipal coastal database 2000, version 3.0. DENR-CMMO, Cebu City, Philippines. 29 p.

DENR, DA-BFAR and DILG (Department of Environment and Natural Resources, Department of Agriculture - Bureau of Fisheries and Aquatic Resources and Department of the Interior and Local Government). 2001. Philippine coastal management guidebook series no. 3: Coastal resource management planning. Coastal Resource Management Project of DENR, Cebu City, Philippines.

Perspectives on a Licensing System for Municipal Fisheries[1]

HUGH TRUDEAU
Fisheries Resource Management Project
Puerto Princesa City, Palawan
Philippines

It is difficult to discuss a licensing system without first describing the environment or infrastructure that will support and use it. For this reason, this paper will discuss peripheral matters as well as the licensing system itself.

Normally, a licensing system is used to achieve one or more of the following objectives:

- data capture on the activity subjected to licensing;
- application of minimum standards of competence;
- regulation or limitation of the activities subject to licensing; and
- revenue generation and collection.

In the context of fishery management, licensing is generally described as a tool of fisheries managers. This implies, however, that there is a formal organization and effort to manage the fishery. Management includes all of the activities that are required in order to monitor the resource and its habitat, evaluate the results on a continuous basis, resolve issues that arise at the earliest possible stage, prepare solutions to perceived problems in the form of a fishery plan, translate that plan into operational plans, prepare supporting legislation when required, and finally apply the solutions through active and dedicated enforcement.

The difficulty in discussing licensing in the context of fisheries management in the Philippines is that this infrastructure does not exist in any municipality at the present time. The Constitution of the Philippines places the responsibility for the protection and management of the resource on the national government. Management of fisheries has been delegated to the municipalities through such instruments as the Local Government Code and the Fishery Code. Municipalities, however, lack the trained professionals to adequately manage the fisheries.

In the present situation, fisheries management is generally a reactive exercise to deal with issues as they arise. This is usually when a situation is so serious as to generate considerable public outcry. Then the matter is relegated to a government department, committee or individual, most often in or associated with the municipal agriculture office. This “firefighting” approach does not address the underlying problems of lack of trained professionals, organizational infrastructure, equipment, training or budgets to properly manage the fishery.

The Fisheries Resource Management Project (FRMP) of the Bureau of Fisheries and Aquatic Resources attempted to design and implement a licensing scheme for municipal governments. The above-mentioned problems, however, had to be dealt with first if the licensing system was to be used to make any real difference. In addition to the basic problems, the approach taken was to encourage a cooperative arrangement between municipalities that share a common bay or fishery. This approach recognized that the initial establishment of a proper fishery management office would be a costly undertaking. By sharing the costs through a bay management center approach, the cost to individual municipalities would be kept to a minimum while ensuring a consistent and professional management system for everyone.

Unfortunately, none of the more than 50 municipalities that were presented with the concept actually took the necessary steps to implement it. No good reasons were given for this lack of implementation but the basic reluctance seems to be

[1] This paper can be cited as follows: TRUDEAU, H. 2004. Perspectives on a licensing system for municipal fisheries, p. 197-199. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

the perception that it is too costly and perhaps too complicated. There may also be an unstated reluctance among the municipalities to give up the autonomy that would result from delegating management responsibility to the bay-level fishery management office. Whatever the reasons, there does not exist a proper fishery management structure in any of the municipalities of the country.

FRMP is faced now with the problem of delivering on its stated goals with respect to licensing systems. The only option is to install stand-alone systems in each municipality and leave them to their own devices as to how the system will be used. The obvious lack of efficiency and effectiveness of this approach cannot be dealt with in the time frames that are left under the terms of the project contract.

How will the above circumstances affect the attainment of the usual goals of a licensing system?

- The first goal stated above is the establishment of a database. This is probably the biggest gain that can be expected from this arrangement. The system will establish a registry of eligible fishers as mandated by Republic Act 8550. It will also establish a register of vessels and gears currently licensed. This in itself is a worthwhile undertaking although it presents some problems with respect to maintaining consistency on a national basis. The question is who will use the database and for what purposes.
- Unlike other licenses such as for a driver, professional and tradesperson, the fishing license does not address the issue of qualifications for fishing other than the usual citizenship requirements. It may be desirable to consider this some time in the future particularly when and if there are training programs available for fisher folks but it is unlikely that this will be the case, particularly for municipal fishers, for the foreseeable future.
- Regulation or limitation of activities is one of the main features of a licensing system in terms of managing fisheries. Potentially the license can limit or regulate the number of people authorized to fish. It is unlikely to be used this way anytime soon even if it is desirable to reduce fishing effort on depleted stocks. A more acceptable application would be to limit the amount and type of gear, the areas open to fishing activities and the time or seasons that would be permitted. These and similar limitations could be applied through conditions to a license. The problem is with the lack of a professional organization to determine what is required and where to apply each of the various limitations.
- Revenue generation and collection is one of the main attractions stated by most if not all of the municipalities when first presented with the licensing scheme. It is, however, misleading to think that this is a vast untapped source of revenue. The current system of licensing in municipalities involves the issuance of a mayor's permit for fishing enterprises. Presumably the fishing license would replace that so that, all other things being equal, the new system would be revenue neutral. There is of course argument that can be made for increasing the license fees, which are nominal at best at present. The fees for licenses should at least offset the costs of management of the resource and at best should address the issues of collecting a resource rent from what is legally a common property resource. This, however, is a very complicated process and will suffer from considerable resistance and the same lack of organization.

There have been many comments made recently in the media regarding the proposed amendment to the Philippine Constitution and change of form of government to a parliamentary type. A few have accurately noted that what is needed is a change of attitude more than a change of form of government. This is also what is required with respect to fisheries management. There are many problems with the current approaches and simply applying technology will not resolve them. Any approach taken or systems introduced will depend in the final analysis on the enforcement effort that is applied to its implementation. Currently, enforcement is relegated to a volunteer approach, which is perceived to be necessary because of the costs that would be incurred from institutionalizing it as part of the fisheries management approach. This argument of course does not value the resource itself or try to determine how much is being lost through improper management and lack of enforcement.

The political nature of the *Bantay Dagat* (sea patrol) being a volunteer program reporting directly to the office of the mayor, ensures that there will be lack of consistency and effectiveness in the enforcement of any fishery laws. There are many laws that have been enacted through municipal ordinance that have never been implemented or enforced. Stories of graft and corruption are rampant everywhere with regard to this approach, which should not be surprising to anyone. Volunteers require income and have expenses as well and the symbiotic relationship that develops between enforcers and illegal fishers is the obvious solution.

Millions of pesos have been spent training people under FRMP and similar projects only to see them replaced after a short time and necessitating the training of their replacements. This is not to say that some of the volunteers are not sincere. It is the system that is faulty, not necessarily the people.

A final thought on the introduction of a computerized licensing system is the operation and maintenance of the system itself. Computers are complicated and sensitive machines that are prone to a multitude of problems. One of the greatest dangers is the poor source of power available in many areas, particularly in the provinces, to run them. Precautions can be taken to minimize this but breakdowns are inevitable. Similarly, software is also prone to problems and corruption and these can result in loss of data and shutdown of the whole licensing process.

Backup systems are necessary for the data and for the entire system. Technically trained people are required to set up, maintain and to further develop the systems as experience is gained in their usage. This requires a commitment of resources beyond the simple training of the licensing operators whose functions are basically clerical in nature. The problems of maintaining centralized (local or national) databases add even more complexity and vulnerability to the system. If the system is simply installed on a municipal computer and the operator trained and then left to his own devices, the system will fail sooner or later.

The bottom line is there is a need for a change of attitude regarding the whole fishery management exercise. Licensing is a tool of management but will not accomplish much if introduced without the necessary infrastructure to use it.

Commercial Fisheries Licensing System[1]

EDWYN B. ALESNA[2]
JOEZEN Q. DIZON-CORRALES[3]
AUSTERLITO CABANGBANG[4]
[2]Licensing Division
Department of Agriculture (DA)
Bureau of Fisheries and Aquatic Resources (BFAR) - Central Office
Quezon City
[3]Coastal Resources Management Section
[4]Licensing Section
DA-BFAR - VII
Arellano Blvd., Cebu City
Philippines

The Concept of Licensing

In a modern society, licensing plays an important role in regulating or controlling many economic activities. Licensing puts order in these activities and contributes baseline information on which policies can be formulated.

In fisheries management, licensing can potentially serve as a means for regulating access to fisheries resources to ensure their viability, integrity and sustainability. Licensing may limit the number of vessels, fishers, gears and gear types, and areas and times of fishing (Trudeau and Federico 2001). Moreover, it is through licensing that the government collects resource rents, which the Fisheries Code of 1998 defines as “the difference between the value of the products produced from harvesting a publicly owned resource less the cost of producing it, where cost includes the normal return to capital and the normal return to labor”. Licensing is, however, not a stand-alone management activity. It must be complemented with regular enforcement, information, education and communication (Pollock 1996).

Current Guidelines on Licensing

In the Philippines, jurisdiction over fisheries is defined by the Local Government Code of 1991 (Republic Act [RA] 7160) and the Fisheries Code of 1998 (RA 8550). Both laws distinguish between commercial and municipal fisheries. Local government units have jurisdiction over the management and utilization of fisheries resources within municipal waters while the Bureau of Fisheries and Aquatic Resources (BFAR) is in charge of resources outside municipal waters. Thus, BFAR is the main agency responsible for managing commercial fisheries.

The Fisheries Code provides the current prescription on licensing commercial fishing vessels, including those fishing in international waters. Section 26 of Article II in RA 8550 states that no person shall be allowed to operate a commercial fishing vessel without a license. All vessels and gears need also to be licensed, otherwise, their operations are illegal. The Code incorporates new provisions regarding the licensing of commercial fishing. The validity of a license for a commercial fishing vessel has been increased from one year to three years. The BFAR Central Office approves applications for new commercial fishing vessel licenses while the respective Regional Offices handle the renewal of such licenses. Commercial fishing gears shall be registered and licensed while fishers aboard commercial fishing shall be licensed as fishworkers. In addition, license fees have been increased by about 20% compared to previous ones.

As of 2002, there were 3,601 licensed commercial fishing vessels in the country employing about 375,000 fishworkers. Reported fish production attributed from commercial fishing was about 976,500 t valued at about P36.1 billion in 2001 (BAS 2002).

---

[1] This paper can be cited as follows: ALESNA, E.B., J.Q. DIZON-CORRALES and A. CABANGBANG. 2004. Commercial fisheries licensing system, p. 200-201. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Issues and Problems in Licensing of Commercial Fisheries

Overfishing in the commercial sector has been reviewed in other papers in this profile. To effectively address overfishing in commercial fisheries, a well-enforced licensing system is required. However, even with the new provisions on licensing in the Fisheries Code of 1998, BFAR is still experiencing problems, including the following:

1. License fees are still greatly undervalued and should reflect the appropriate resource rents.
2. Many commercial fishing vessels are currently operating without licenses.
3. Many fishing boats are dubiously registered as being under 3 GT and are thus licensed as municipal fishing boats, but upon inspection are well above 3 GT.
4. There is a need to reclassify what constitutes a commercial fishing boat. Ideally, this should be based not only on the size of the boat, but also on the fishing gear and associated technologies used.
5. Currently, BFAR makes no link between the new licenses that it issues and the capacity of fish stocks to withstand more fishing effort. Licenses are still issued without adequate assessment of fish stocks.
6. There is muddled jurisdiction among the Philippine Coast Guard, the Maritime Industry Authority and BFAR on licensing and classification of boats.
7. Once BFAR issues a license, it does not conduct adequate monitoring, control, and surveillance of how it is used and where the boat operates.

Current Thrusts to Rationalize the Licensing System

In 2003, BFAR will implement a project that will undertake a national registration of commercial fishing vessels. Basically, the project will take stock of the number of fishing vessels operating legally or illegally in Philippine waters. A computerized licensing system will also be instituted to process the data collected. Using the information, BFAR can then review its existing licensing policy and revise it as necessary. The review will also address in part the provisions of the Fisheries Code, which is up for amendment after its first five years of implementation.

Part of the exercise is the designation of a three-month registration period for licensing of commercial fishing vessels. Those who are unable to obtain a license during this period will be prohibited from fishing by the access limitation rules or the revised rules for control and management of commercial fisheries that will be developed. However, this will require collaboration among enforcement agencies.

An equally important activity is the declaration of a one-year moratorium on the issuance of new fishing vessel and gear licenses, importation of fishing vessels, new construction of commercial fishing vessels, renovation or refit of existing vessels, and transfer of licenses of existing vessels. Other activities will include preparation of registration forms, orientation of licensing officers, information dissemination, and review and revision of the current licensing policies.

Data on the status of fisheries stocks taken from the National Stock Assessment Project will also be evaluated, including current levels of fishing effort. The information will then be used to estimate the maximum sustainable yield of a fishery, which will be the basis for limiting the number of fishing vessels to be licensed. Moreover, a review of existing license fees will be undertaken in order to extract true resource rent values.

References

BAS (Bureau of Agricultural Statistics). 2002. Fisheries statistics of the Philippines, 1997-2001. Department of Agriculture - BAS, Quezon City, Philippines.

Pollock, B. 1996. Fisheries management in the Philippines: A brief review. *In* Main report of the Second National Fisheries Workshop on Policy Planning and Industry Development. Vol. 2. Department of Agriculture-Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines, and Food and Agriculture Organization, Rome, Italy.

Trudeau, H. and C. Federico. 2001. BFAR national fisheries licensing system. *In* Commercial fisheries licensing manual. Vol. 2. Fisheries Resource Management Project, Department of Agriculture-Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Size Limits on Fish Caught[1]

NYGIEL B. ARMADA
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo, 5023
Philippines

Background

A major impact of excessive fishing is the reduction of average size of fishes. It is not uncommon to observe such occurrence in tropical fish stocks such as those in the Philippines. Fishers continuously develop fishing gears in response to the changes in fish stock they exploit. One such adaptation is the continued decrease in mesh sizes due to ever smaller and smaller fishes available in the fishing ground. Initially, most fishers will be using nets with bigger mesh sizes and will spend less time fishing. As the stock becomes more exploited, the fishes become progressively smaller while fishers adapt by making nets with smaller mesh sizes. This continues until fish depletion will force the fishers to use fine-meshed nets and spend more time fishing.

By using small or fine-meshed nets, fish are actually caught at an early stage in their life, preventing them from growing to sizes at which maximum benefit can be derived in terms of biomass. This condition is known as growth overfishing (Pauly 1988). It has two consequences, namely: (1) the average sizes of target species will progressively decrease or (2) the target species will become depleted and will be replaced by other small-sized, fast-growing species. Whichever the case, fish sizes will progressively decline. This, likewise, means lesser yield for the same number of young, which requires that more fish be caught to land the same volume of harvest. The fishes cannot grow older and the number of parents in the stock will become less and less each time around. This means that succeeding batches will produce fewer eggs and young and some may never have a chance to reproduce at all. The fishing pressure on the small individuals may become too strong that in the long run the subsequent catch will be composed mainly of immature or even juvenile individuals (Table 1) and many may not have the chance to grow to their reproductive ages. With this situation, allowing the fish to spawn at least once in their life could have a considerable impact on the future fish population.

The Theory Behind Size Limits

Fisheries biologists have studied the effects of overfishing in general and growth overfishing in particular on harvestable fish biomass. Some methods to determine biological reference points were developed and measurements were compared to known or expected values. This measured the possible negative effects of growth overfishing with the aim of zeroing in on management interventions that may avert depletion. The combined effects of fishing effort and the average size when a species of fish is being harvested can be investigated using the Beverton and Holt (1957) yield per recruit model or the Thompson and Bell (1934) model.

With progressively increasing fishing effort, the average yield from each individual fish entering a fishery will initially increase, reach a maximum and then ultimately decrease. Likewise, harvesting fish at a certain size will yield a maximum harvest and then become less as smaller fishes are harvested. It is even possible to come up with a good combination between appropriate fishing effort and size of fish being harvested to optimize the use of harvestable biomass. This single species approach can only be applied to tropical fisheries in which one or a few fish species dominate the catches.

[1] This paper can be cited as follows: ARMADA, N.B. 2004. Size limits on fish caught, p. 202-205. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Table 1. Relative abundance (%) of different stages of maturity of selected species caught by trawl from August 2000 to July 2001 in Sapian Bay, Philippines (modified from Armada 2002).

Species	Stages of Maturity					
	Juvenile	Immature	Maturing	Mature	Gravid	Spent
Alepes djedaba	93	2	1	2	2	0
Dendrophysa russelii	18	14	28	28	12	0
Gazza minuta	65	8	15	9	3	0
Gerres abbreviatus	71	20	4	4	1	0
Gerres filamentosus	58	19	8	7	8	0
Gerres oyena	86	10	2	1	1	0
Leiognathus bindus	94	2	2	2	0	0
Leiognathus brevirostris	41	10	19	24	6	0
Leiognathus elongatus	80	3	7	7	3	0
Leiognathus splendens	65	12	11	8	4	0
Saurida undosquamis	63	15	11	7	4	0
Secutor ruconius	43	6	16	27	8	0
Selaroides leptolepis	49	3	10	28	10	0
Sillago sihama	56	6	16	15	7	0
Sphyraena barracuda	72	14	6	6	2	0
Upeneus sulphureus	87	3	3	4	3	0
Valamugil cunnesius	67	5	12	11	5	0

Both models can likewise be expanded to multispecies and multigear fisheries that are typical in the tropics. The expanded application of the models can show gear and species interaction and even economic interaction if monetary values are assigned. Silvestre (1990) calculated the appropriate mesh size and mortality combinations where yield and values are maximized from the demersal multispecies mix of Lingayen Gulf, Philippines. In brief, both the biological and economic rents can be predicted from the various levels of exploitation and mesh sizes being used, thus indicating the appropriate combinations of fishing effort and mesh size to yield the maximum harvest.

Towards the Application of Size Limits

There might be awareness of the wisdom of imposing size limits on fish caught in the Philippines. However, what really have been done so far to support or implement such initiative? A provision in Philippine fishery law says that fishers are not allowed to use nets with mesh sizes smaller than 3 cm. For fast-growing demersal fishes and small pelagics, this may be adequate. The 3.5 cm size may be appropriate for the demersal species mix of Samar Sea and San Pedro Bay (Silvestre and Soriano 1986; Armada 1996). But who among the fishers are taking the mesh size limit seriously? Figure 1 summarizes the size composition of various fishing gears catching sardines (*Sardinella fimbriata*) in the waters of Antique. The figure clearly shows that sustenance fishing gear like beach seine catches smaller individuals compared to other sustenance gears like hook-and-line and gillnet, and even when compared to a fishing gear operated on board commercial boats like ringnet.

This issue regarding the destructive effect of fine-meshed nets of beach seines was raised with fishers during information campaigns and other occasions. A gear-swapping program in favor of a less destructive gear like gillnet was even attempted. In the end, however, although fishers fully understood the destructive effects of fine-meshed nets, they could not be convinced to abandon beach seine because no other gear could replace it in terms of assuring daily catch and spreading immediate benefits to many people involved in pulling the net to the shore.

There is also the issue of the appropriateness of the 3 cm minimum mesh size limit to slow-growing large species of fish. For large pelagic species like tuna, this mesh size limit is too small. In fact, other countries exploiting tuna and tuna-like species claim that Philippine fishers are catching the young and juveniles of these species through the use of ringnets and purse seine in combination with *payao*, a fish aggregating device. Ganaden and Stequert (1987) showed the preponderance of small and immature yellowfin tunas (*Thunnus albacares*) caught in the Philippine waters compared to those caught in other areas like the Western Pacific, Western Atlantic and Western Indian Ocean (Figure 2).

Size limits on fish catch may also be indirectly achieved through restriction of fishing activities in a specific fishing ground or during a specific period of time. The creative design and application of area

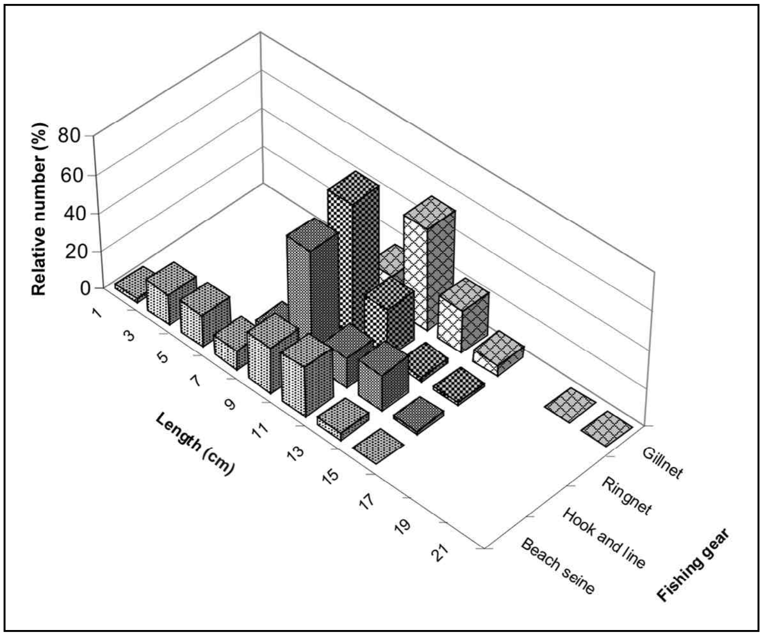


Figure 1. Length composition of sardines (*Sardinella fimbriata*) caught by various fishing gears in the waters of Antique (modified from Armada 1992).

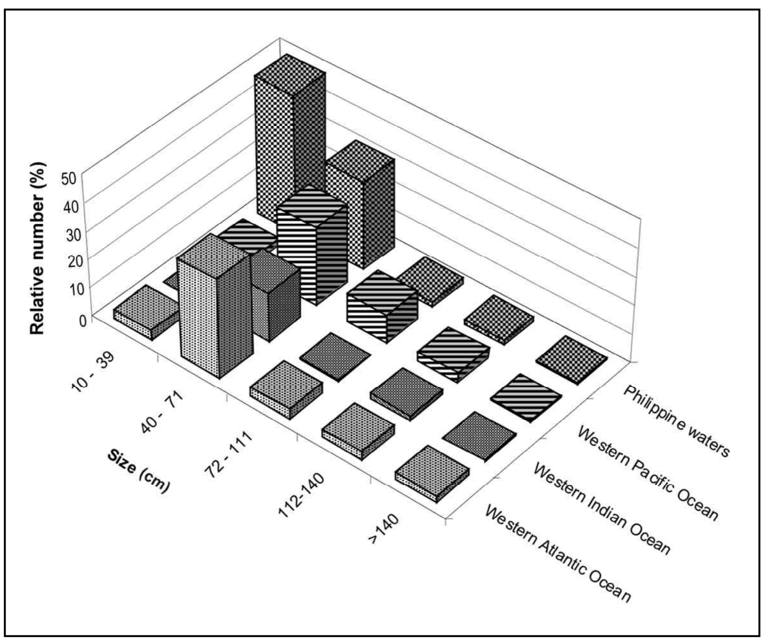


Figure 2. Size composition of yellowfin tuna catches in the Philippines, compared to that of other fishing areas in the Western Pacific, Western Atlantic and Western Indian Ocean (Ganaden and Stequert 1987).

restrictions as regulatory measures still need to be fully tapped by management entities in the Asian region (Silvestre 1995). A number of legal measures restricting fishing during a specific period of time are already in place. However, compliance with time restrictions has been inconsistent perhaps because they are unreasonably long from the point of view of resource users. Fishing, even for sustenance or on a small-scale level, is primarily an economic activity. Thus, fishers cannot be separated from their livelihood for a long time without viable livelihood alternatives.

There is, therefore, a need to refocus time restriction towards shorter but optimally effective time periods. Closed seasons should be short but enforced during particular periods when a substantial number of adults can be guaranteed to spawn and there is a high probability of survival for the young. Small and inexpensive biological studies such as sexual maturity monitoring of commercially important species should be pursued to determine the shortest but optimally viable period for restricting fishing. Such studies can be done together with the fishers to facilitate the work and, most importantly, to ensure efficient communication of results and proper understanding of the whole intention. There is also a need to harness existing scientific routines, such as fishing gear selectivity and size at maturity studies, to provide the basis for fisheries management options. The results of such studies can also be used for information materials depicting appropriate mesh sizes and minimum size of fish. The modest target could be to ensure sustained harvest by allowing the fish to spawn at least once, before being caught, therefore, always ensuring the next generation for fishers to catch.

References

Armada, N.B. 1992. Fisheries resource assessment study of coastal waters of Antique, Philippines. Report submitted to Antique Integrated Area Development and Pacific Rim Innovations and Management Exponents, Inc., Antique, Philippines. 56 p.

Armada, N.B. 1996. Trawl survey of San Pedro Bay, Philippines. Vol. 5: The fisheries of San Pedro Bay, Philippines. IMFO Tech. Rep. No. 16: 41-55. Institute of Marine Fisheries and Oceanology, College of Fisheries, University of the Philippines - Visayas, Iloilo, Philippines.

Armada, N.B. 2002. Fishery resources assessment of Sapian Bay, Philippines. Resources and socio-economic assessment of Sapian Bay, Philippines. Final Report to the Fisheries Resource Management Project, Department of Agriculture, Quezon City, Philippines.

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. Fish. Invest. (2 Sea Fish.) 19: 533 p. Ministry of Agriculture, Fisheries and Food, London, UK.

Ganaden, R. and B. Stequert. 1987. Tuna fisheries in the Philippines. Proceedings of the Second Meeting of Tuna Working Groups in the Southeast Asia Region, 25-28 August 1987, Manila. Indo-Pacific Tuna Development and Management Programme, Colombo, Sri Lanka.

Pauly, D. 1988. Some definitions of overfishing relevant to coastal zone management in Southeast Asia. Trop. Coast. Area Manage. 3(1): 14-15.

Silvestre, G. 1990. Overexploitation of the demersal stocks of Lingayen Gulf, Philippines, p. 873-876. *In* R. Hirano and I. Hanyu (eds.) The Second Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines.

Silvestre, G. 1995. Fisheries management and the selectivity of fishing operations. Paper presented at the Consultation of Experts and Industry on Selective Fishing for Responsible Exploitation of the Resources in Asia, 12-17 October 1995, Beijing, China.

Silvestre, G. and M. Soriano. 1986. Effects of incorporating sigmoid selection on optimum mesh size estimation for the Samar Sea multispecies trawl fishery, p. 482-492. *In* S.C. Venema, J.M. Christensen and D. Pauly (eds.) Contributions to tropical fisheries biology: Papers for the FAO/DANIDA Follow-up Training Courses on Fish Stock Assessment in the Tropics, 5-30 May 1986, Hirtshals, Denmark, and 12 January - 6 February 1987, Manila, Philippines. FAO Fish. Rep. (389):519 p.

Thompson, W.F. and F.H. Bell. 1934. Biological statistics of the Pacific halibut fishery. 2. Effect of changes in intensity upon total yield and yield per unit of gear. Rep. Int. Fish. (Pacific Halibut) Comm. (8): 49 p.

Fisheries Management and Enforcement[1]

MARLITO N. GUIDOTE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

The role of fisheries law enforcement in fisheries management is to ensure that all regulatory or restrictive management interventions are complied with by specific individuals or communities. Achieving this goal involves motivating the regulated community to comply by means of compliance strategies and enforcement programs (EPA 1992).

There are three main actors in fisheries law enforcement: the regulatory managers or those who formulate regulatory or restrictive acts; the regulated communities or those whose actions are regulated; and the enforcers or those tasked to ensure that regulations will be complied with. In the Philippines, for example, local legislative bodies such as the Sangguniang Bayan may pass an ordinance regulating the use of compressor by municipal fishers within their area of jurisdiction while tasking the municipal agriculturist to ensure compliance or else apply the necessary sanctions (Figure 1). The Sangguniang Bayan then is the regulatory manager, the municipal fishers are the regulated community while the municipal agriculturist is the enforcer. The collaboration between and among the three actors will spell success or failure of fisheries law enforcement.

Regulatory Managers and the Fisheries Resources

Under the decentralized system of government, regulatory management affecting fisheries is shared

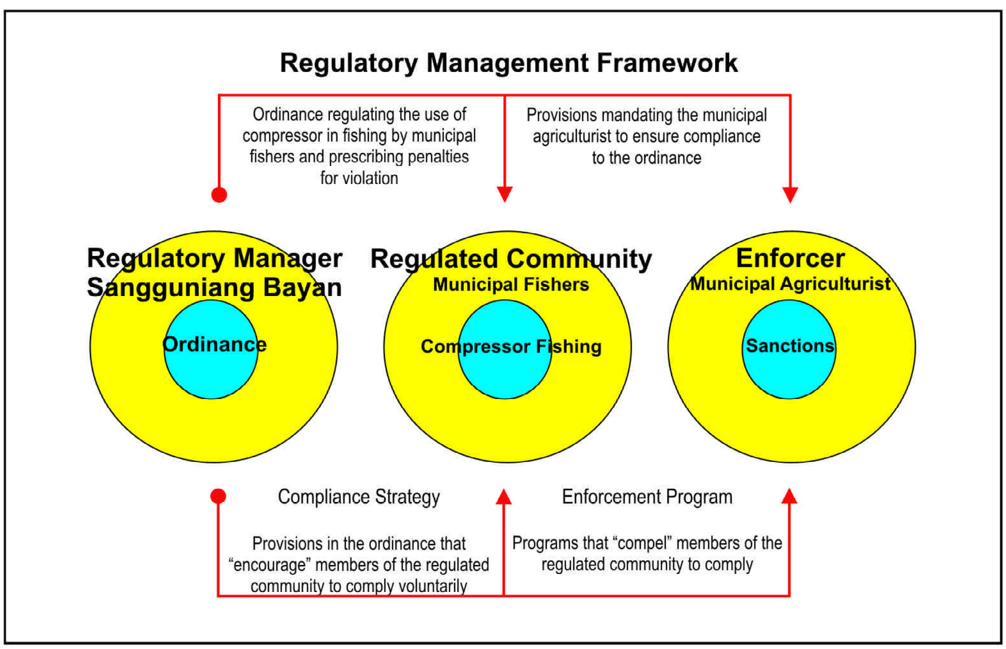


Figure 1. The role of the three actors in fisheries law enforcement as illustrated by the case of an ordinance regulating fishing with use of compressors.

[1] This paper can be cited as follows: GUIDOTE, M.N. 2004. Fisheries management and enforcement, p. 206-214. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

both by the national government and the local government. The Fisheries Code of 1998 and the Local Government Code of 1991 provide the framework by which these regulatory powers are shared by the two levels of government.

The Fisheries Code of the Philippines (Republic Act [RA] 8550) mandates the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) as the lead agency in formulating regulatory mechanisms directly related to fisheries. However, other agencies under the executive branch of government may also institute regulations that indirectly affect fisheries. For example, the Department of Transportation and Communication (DOTC), with attached agencies including the Philippine Coast Guard (PCG) and the Maritime Industry Authority (MARINA), regulates commercial fishing vessel licenses and enforces anti-pollution measures in shipping. Likewise, the Department of Environment and Natural Resources (DENR) regulates foreshore and shoreline areas.

The Local Government Code meantime gives the local government units (LGUs) and the national government the shared responsibility of managing and maintaining ecological balance. It also gives local governments the authority to enforce fishery laws in municipal waters and laws pertaining to the conservation of mangroves. Local legislative bodies such as the Sangguniang Bayan (Municipal Council), Sangguniang Panlungsod (City Council) and Sangguniang Panlalawigan (Provincial Board) may issue fisheries ordinances in their respective areas of jurisdiction, as long as they are consistent with national regulations.

Regulatory management in fisheries has become progressively more important due to the increasing awareness of the relevance of the fishing sector to Philippine society. As a major fish-producing country, the Philippine population is highly dependent on fish food. Recorded per capita consumption of the fish, meat and poultry food group is 54 kg/year in 1993 of which 67% is composed of fish and fish products (DA-BFAR 1995). Fisheries contributed 3.5% to the gross domestic product in 1996 and provided employment to about 1 million people (DA-BFAR 1997).

Over the years, Philippine fisheries have seen an upsurge in illegal and destructive fishing practices (DENR *et al.* 2001). Such practices have a long history in coastal communities. Dynamite fishing for instance has been around since the First World War in Lingayen Gulf while the use of sodium cyanide and other poisonous substances has been occurring in the same area for over three decades (Galvez *et al.* 1989).

Apart from these, regulations concerning commercial fishing operations never seem to achieve an acceptable level of compliance (Trinidad *et al.* 1993; Israel and Banson 1996; White and Cruz-Trinidad 1998) in spite of so many government interventions. Marine-based pollution, such as oil spills, ballasts and bilge discharges, garbage and solid waste dumping from ships have also been on the upsurge due to heavy shipping traffic (Burke *et al.* 2002). These and other factors that affect water quality expose marine fisheries to more vulnerabilities. As a result, fish catch declines while the conflict between municipal fishers and commercial fishers intensifies (DENR *et al.* 2001).

Fisheries regulations therefore must strike a balance among maintaining healthy fisheries, ensuring the survival of municipal fishers and allowing commercial fishers to stay in business. To do this is tantamount to limiting certain activities, changing behavior and outlook of some sectors and even introducing new paradigms through restrictive or regulatory management to counteract long years of neglect and destruction.

The Philippine government has always relied principally on regulatory mechanisms to manage the marine and coastal zones, particularly to control activities, allocate resources among users and potential users, and resolve conflicts among competing values. Though regulatory mechanisms have their specific functions, sole reliance on them has proven quite insufficient and ineffective in abating the degradation of marine and coastal resources. There have been telling stories of management successes and failures along this line over the years (DENR/UNDP 1997)

There are two broad categories of regulatory mechanisms in fisheries: (1) limiting access and use of resources and (2) general environmental protection (DENR/UNDP 1997). When the regulatory task involves limiting access to, and use of, resources, DA-BFAR is the regulatory manager for resources outside municipal waters while those within municipal waters are regulated by municipal/city LGUs. On the other hand, with regard to general environmental protection, DENR is mandated to conserve and protect coastal and marine environment with LGUs sharing the responsibility in their respective territories (Local Government Code of 1991). (See Table 1).

Introduction of restrictions and regulations, whether of the national government or LGUs, does not automatically translate to changing behaviors or outlook of fishers. However, studies indicate that the degree of acceptance by the regulated community of any restrictive or regulatory management intervention may depend on the strength of the compliance strategy that goes with the restriction (EPA 1992).

A well-designed regulation has greater chances of achieving compliance while a poorly designed regulation may even worsen enforcement efforts. The best regulations are those that motivate or encourage the regulated community to comply voluntarily and those with mechanisms that enable enforcers to compel compliance. Among the fisheries regulations that are difficult to enforce are those related to excluding commercial fishing in municipal waters, use of prohibited gears (Figures 2 and 3) and of poison and explosives in fishing and licensing of vessels engaged in fishing (Table 2).

The Regulated Community and the Challenge of Compliance

The activities of individuals and communities that directly or indirectly affect fishing and the coastal ecosystem are regulated under various laws, rules and regulations. The legal instruments that bind these regulations include codes, laws, memorandum orders and the like. Ideally, the regulated community complies voluntarily with the regulations, otherwise sanctions are imposed to compel compliance (Table 3).

Regulations directly affecting fishing activities are covered by the Fisheries Code of 1998 and the various Fisheries Administrative Orders. These are further refined to suit local applications of ordinances by LGUs. The regulated community under the code are the municipal fishers, fishworkers, commercial fishing boat owners and boat captains. The code also restricts certain law enforcement activities, thus, even enforcers may be considered part of the regulated community. The National Integrated Protected Area System (NIPAS) Act of 1992 to a certain degree also directly affects fishing. Other than those mentioned, the local government, which is both a regulatory manager and enforcer, is part of the regulated community under the NIPAS Act.

Some activities that indirectly affect fishing and coastal ecosystems are covered under the Philippine Merchant Marine Rules and Regulations (PMMRR) of 1997. The regulated communities under PMMRR include all maritime industry workers such as fishing vessel crew professionals and nonprofessionals alike.

There are also special regulations that restrict certain activities specifically related to fisheries law enforcement such as the Ombudsman Act of 1989 (RA 6770), the Anti-graft and Corrupt Practices Act (RA 1379), Code of Conduct and Ethical Standards of Public Officials (RA 6713) and the Revised Penal Code. Regulated communities under these laws are the local government officials and the fisheries law enforcers.

Some writers note that the Philippines has a collection of stringent environmental laws but the problem always lies in implementation (Pal and

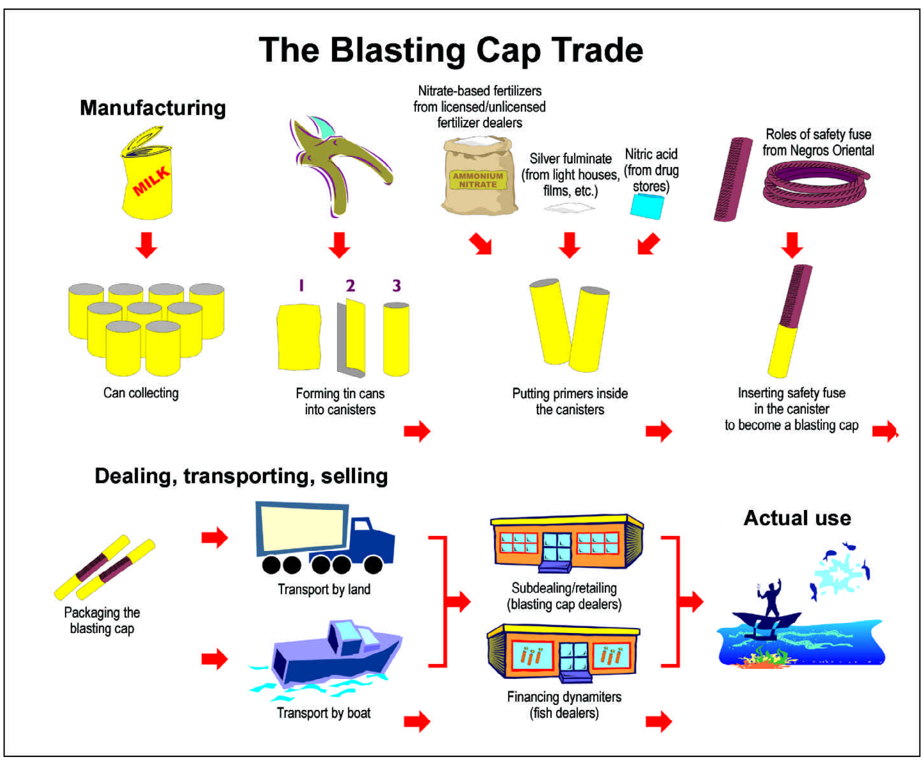


Figure 2. Curtailing blast fishing, which is one of the more difficult tasks in fisheries law enforcement, requires, among other things, an understanding of how violators are able to procure blasting caps.

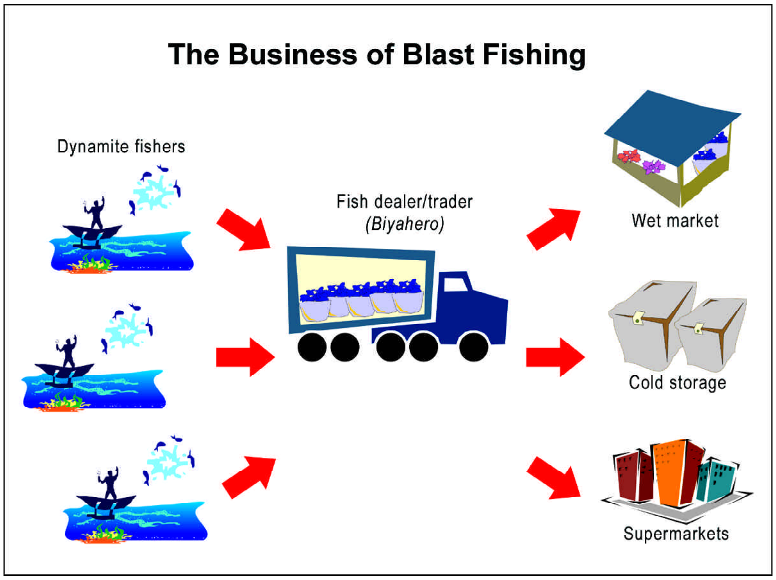


Figure 3. Law enforcers must have a knowledge of the production and distribution points of blast fishing.

Zarcadoolas 2002). Legislative measures alone have minimal effect in conserving natural resources since these are often ignored by people who face more pressing issues of survival.

There are many factors that lead to nonimplementation of regulations and noncompliance of people depending on the regulatory situation, economic circumstances and cultural norms of the regulated community and even values of regulatory managers and enforcers. The sociocultural, economic, personal or psychological, institutional and technological factors affect regulations and compliance (EPA 2002).

In the case of dynamite fishing, for instance, the study of Galvez *et al.* (1989) shows that sociocultural factors outweigh the logic behind the purpose of the law. The authors note that using dynamite was viewed by the community as victimless crime and therefore does not bear guilt upon perpetrators. Besides, informants claim that effects of blast fishing are limited to a small area, compared to trawl fishing.

Economics becomes a serious factor when the benefit of noncompliance outweighs that of complying. Tolerance and acceptance of blast fishing practice pervades when almost all members of the regulated community benefit from it. Whenever the blast fisher comes home, his catch is shared with many, including local officials and police who participate in a feast (Galvez *et al.* 1989).

Personal and psychological factors will always be part of noncompliance and are addressed on individual basis by enforcement and rehabilitation. An interview conducted by the writer with World Wide Fund for Nature-Philippines among fishers of Tañon Strait in Southwestern Cebu and Southern Negros Oriental revealed that killing dolphins and other cetaceans is practiced because they are seen as competitors of fishers (WWF unpubl.).

Critical in fisheries enforcement are institutional and technological factors that affect compliance. In the delineation of municipal waters, for instance, the Department of Justice (DOJ) Opinion No. 100, S. 2002 stated that DA and not DENR should issue the guidelines delineating municipal waters. This opinion led to the revocation of DENR Administrative Order 17, S. 2001 (DAO 17) through DENR Administrative Order No. 7, S. 2003 in spite of the fact that DAO 17 was already in effect for two years. An earlier Opinion of DOJ (Opinion No. 67, S. 2001) did not raise the issue of authority of the issuing office but merely stated that guidelines on the delineation / delimitation of municipal waters are not legal but technical issues. Such conflicting and confusing issuances that affect fishing activities results in nondeliberate or deliberate noncompliance.

Another institutional issue is the national government's promotion of fish aggregating devices. Such devices contribute to overfishing and encourage intrusion of commercial fishing vessels in nearshore marine waters (Green *et al.* 2002).

Technological factors related to logistics and budgetary constraints also contribute to noncompliance. One clear example is the absence of a vessel monitoring system needed in monitoring, control and surveillance against foreign fishing fleet intrusions. This technological weakness results in

Table 1. Regulatory agencies and mechanisms.

Regulatory Agency	Regulatory Mechanism	
	Limiting Access to and Use of Resources	General Environmental Protection
National		
DA-BFAR	Fishing in Philippine territorial waters except municipal waters	Use of active and passive gears
DENR	Utilization of shoreline and foreshore areas Activities on areas under NIPAS Act	Issuance of Environmental Compliance Certificate Approval of Environmental Impact Statement
DOTC (PCG/Marina)	None	Issuance of fishing vessel permits and licenses and marine pollution control
PNP	None	Trading, transport of ammonium nitrate agricultural grade (in blast fishing)
Local		
Provincial government	Issuance of permit for sand extraction	Maintenance of ecological balance
Municipal/city government	Fishing inside municipal waters	Maintenance of ecological balance and solid waste management
Barangay government	None	Solid waste management and marine pollution

Table 2. Regulated activities and barriers to compliance.

Regulated Activity	Regulated Community	Barriers to Compliance (of Regulated Community)	Regulatory Managers
Fishing inside municipal waters	Commercial fishing vessel operators	No budgetary allocation for vessel upgrade of small and medium-scale commercial fishers to operate beyond 15 km from shoreline (RA 8550)	DA-BFAR
Licensing of commercial fishing vessels	Commercial fishing vessel operators	No coordination of licensing and permitting agencies due to procedural lapses	DA-BFAR, PCG-MARINA
Declaration of amount of fish catch	Commercial fishing vessel operators	Tax disincentives from the Bureau of Internal Revenue (BIR)	DA-BFAR, BIR
Accreditation of fishing vessel makers	Traditional boat makers	No government incentive for complying	MARINA
Importation, storage transport and trade of ammonium nitrate	Traders of ammonium nitrate	Demand of mango traders for flower inducers	PNP Firearms and Explosives Office
Use of noxious and poisonous substances in fishing	Municipal fishers	Demand and easy cash for aquarium fishes and live fish trade	LGU
Municipal fishing registration	Municipal fishers	Lack of uniform system among LGUs	Local government

Table 3. Regulations and regulated communities.

Source of Regulation	Regulated Community	Regulated Activities
NIPAS Act, 1992	Local government officials	Exercise of local government jurisdiction over marine protected areas
PMMRR 1997	Fishing vessel crew	Compliance of boat captain and crew to documentary requirements, such as permits and licenses to practice skills and profession related to maritime travel
Fisheries Code, 1998	Commercial fishing boat owners	Compliance by owners to required licenses of fishing vessels and registry of fish catch
Ombudsman Act, 1998	LGU officials and law enforcers	Enforcement of laws, rules and regulations by government officials without fear or favor

undetected poaching by foreign vessels in Philippine territorial waters.

The Fisheries Enforcer and the Enforcement Response

The bulk of the fisheries law enforcers' work falls on their ability to detect violations and to respond appropriately. The ability to detect violations automatically assumes that the enforcers have the operative understanding of regulations and necessary wares to prevent violations from continuing by neutralizing the violator. However, one important factor to consider, especially in a legalistic society, is the enforcer's jurisdiction over the violations. At times, authority and jurisdiction influences the enforcement response.

Who then are the fisheries law enforcers? Unlike other countries that have fishery law enforcers who are mandated solely to enforce fishery laws, Philippine laws, such as the Fisheries Code of 1998 and the Local Government Code of 1991, identify multiple agencies to enforce them. There are at least seven national government agencies and local government offices tasked with enforcing various aspects of fishery laws (Table 4). Section 124 of the Fisheries Code, for instance, authorizes the enforcement officers of BFAR, Philippine Navy, PCG, Philippine National Police (PNP), PNP-Maritime Command, LGUs and other national government agencies to enforce the code and all other fishery laws, rules and regulations (see Figures 4 and 5). These offices and agencies, which have other functions, at times have complementing but more often overlapping functions related to enforcement of fishery laws. Still, others, such as international environmental lawyer Antonio A. Oposa, Jr., defend the overlaps as intentional if only to emphasize that the job of enforcing environmental laws is the job of everyone.

Enforcement response is founded on the authority and jurisdiction of the enforcer over the violation and the violator. It should be understood that many environmental law violations, fishery laws not withstanding, occur in progression and the enforcer's jurisdiction over them varies at every stage. Enforcement response follows a continuum from prevention to apprehension and prosecution (Table 5). There are fishery law enforcers that have the primary mandate of preventing violation from occurring in the first place while others have the specific authority to search, arrest, seize and take custody of evidences, and while yet another set of enforcers has the distinct mandate to prosecute violations. All of these actions constitute enforcement response. This is also one reason why the government authorizes many agencies and offices to enforce fishery laws.

Enforcement response of law enforcers in the Philippines has been dictated by the primary mandate, authority and jurisdiction of the responding agency. While the task of fisheries law enforcement has been distributed among various agencies in Section 24 of RA 8550, it is still expected that the primary agency tasked to enforce particular regulations in RA 8550 should be the first to respond. The experience of LGUs, which sometimes seek the intervention of the Philippine Navy in desperate attempts to address persistent illegal fishing activities, has always been unpleasant as their requests are either referred to BFAR, PCG or the boatless PNP.

Table 4. The authority and jurisdiction of fisheries law enforcers.

Fisheries Law Enforcer	Authority	Jurisdiction related to Fisheries
BFAR	RA 8550 RA 9147	All Philippine territorial waters except municipal waters All aquatic critical habitats, aquatic resources
Philippine Navy	RA 8550	Exclusive economic zone
PCG	RA 8550 EO 477	Philippine territorial waters Ships plying Philippine territorial waters
PNP-local	RA 8550 RA 8551, amending RA 7965	Municipal waters/area of operation (AOR) As specified in AOR of the unit
PNP-Maritime	RA 8550, RA 8551	Criminal aspect of violations committed inside Philippine territorial waters
Deputized fish wardens/ local enforcers	RA 8550, LOI 1328	Municipal waters
DENR	RA 8550 RA 9147 RA 7586	Projects impacting marine environment Turtles and tortoises and wetland species Fish sanctuaries, nature reserves, mangrove reserves


SUN STAR
NO. 1 IN READERSHIP
SUNDAY

Giant clams seized in 3 cities, 1 town

6 multi-agency teams wage drive; seafood restaurants to lose menu

Figure 4. Enforcement of fishery law is often done by a multi-agency task force. In a story that made the headlines, a multi-agency task force of PNP, BFAR, DENR, Coast Guard and local government fisheries enforcers successfully conducted joint operations in Mactan, Cebu, in 2003.

While local government officials should be the first line of defense in fisheries law enforcement, their treatment of enforcement is typically reactionary and impulsive and not programmatic. Therefore, in the absence of any local policy or protocol for enforcement response appropriate to an LGU, LGUs and national government agencies will always have the tendency to pass on the responsibility of fisheries law enforcement from one agency or office to the other leaving the community with little choice but to take the law into their own hands on the delicate basis of the Rule of Court (citizen's arrest), which does not always shield them from countersuits.

For successful fisheries law enforcement, the regulation must be firmly grounded on social, economic, political, technological and cultural norms of the regulated community. If the regulation attempts to alter the normative values of the community, it must have a fine mix of encouragement to motivate and force the members to comply at the same time.

Conclusion

Effective fisheries law enforcement does not need to constantly compel compliance. From policymaking to actual enforcement of regulations, the fundamental objective should be to encourage voluntary compliance. Poorly planned regulations will never achieve voluntary compliance and will always pose difficulties in enforcement no matter how creative enforcers are. It is therefore important that regulations are properly formulated and founded scientifically and whenever possible, culturally. Regulations should be crafted in the most transparent and participatory manner, perhaps even involving the media at the onset because their understanding of the issue is critical in advocacy. Like laws, regulations must be socially marketed to those affected (Oposa 1999). Their promulgation must be announced in the widest extent possible with every effort to convey their essence, rationale and benefits to the affected community. Making the regulated community understand that the long-term benefits of a regulation outweigh its immediate drawbacks has a better chance of encouraging voluntary compliance. A multimedia approach (radio, TV, comics) with emphasis on dwindling fisheries resources, strengthening fishers' organizations and stronger coordination between and among law enforcement bodies (Galvez *et al.* 1989) may alter norms, beliefs, behavior and even myths of communities on illegal and destructive fishing practices over time.

There should also be special attention given to sociocultural, economic, institutional and technological implications of regulations to the regulated community. Such information should be used to formulate incentives for complying. An example is the Memorandum Order of DOTC that guarantees amnesty for unlicensed bancas and socialized rates for those voluntarily registering during a grace period.

Supplemental livelihood is another compliance strategy employed by both national agencies and LGUs. Mariculture and aquaculture are being promoted by BFAR as alternatives to fisheries extraction from the


S. Gulayan

Figure 5. Fish examinations are conducted regularly by a multi-agency task force called the Coastal Law Enforcement Alliance in Region VII.

Table 5. The enforcement-response continuum.

Prevention	Apprehension (Search, Arrest, Seizure, Custodial Investigation)	Prosecution
All local government officials and national government agencies	BFAR, PCG, PNP-Maritime, PNP	Prosecutors, National Bureau of Investigation, Police (criminal), BFAR, DENR (administrative)

wild. In San Vicente, Palawan, and Gilutungan Island, Cebu, communities engage in seaweed farming and jointly police their waters from dynamite fishers as this affects their livelihood**.** Showcasing best practices by other communities in fisheries management and enforcement sometimes provides information, inspiration and subtle suggestions to other local decisionmakers and communities.

Peer pressure can be particularly effective. It is best applied to individuals and minority groups in the community who are noncompliant. Self-interest of the individuals and the community must also be understood and the regulations must somehow conveniently fit into that self-interest of the majority or the larger society who stand to gain from it.

Even with compliance strategies in place, enforcement programs must also be equally strong so that the gains from effective fisheries management will be sustained. A strong enforcement program lends credibility to the regulating office and the legal system that supports it and promotes fairness to those who comply (EPA 1992). The involvement of enforcers in crafting regulations is also important especially those who have a larger stake in the enforcement continuum such as the police. Experienced enforcers can give regulatory managers very good perspectives on the enforceability of regulations.

Training and continuing education of fisheries law enforcers is important. The growing sophistication of the *modus operandi* and instruments used by violators at times outdate the skills and knowledge of enforcers to detect and stop them. It is therefore important that fisheries law enforcers must be up to speed with the latest technology being used by violators and updated by newer techniques to interdict them.

Scientific and academic communities must also support and participate in upgrading the skills of nontechnical fishery law enforcers, such as the police, coast guard and even deputized fish wardens.

Enforcement response at every stage of the continuum must be ascertained. Preventing violation even before it actually occurs is better than apprehension. Regulatory managers must be able to utilize every available educational tool, information, communication and community outreach opportunity to convey the essence of the regulation to the regulated community.

If prevention is no longer possible, apprehension must be grounded on the strongest technical and legal bases. Enforcers must be trained continually and professionally on skills relative to search, arrest, seizure and handling of the evidences. These skills upgrade must ensure the highest degree of competency and integrity as prerequisite to successful prosecution.

Lastly, fisheries regulatory managers must ensure that the players in the prosecution stage of enforcement response are continually updated about new regulations. A good judgment is hinged on effective prosecution. As Oposa noted (1999), swift and painful judgment made public achieves the desired deterrent effect.

References

Burke, L., E. Selog and M. Spalding. 2002. Reefs at risk in Southeast Asia. World Resources Institute, Washington DC, USA.

DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). 1995. On the allocation of fishing areas for exclusive use by municipal fisheries sector: A policy brief. DA-BFAR, Quezon City, Philippines. (Unpubl.).

DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). 1997. 1996 Philippine profile. DA-BFAR, Quezon City, Philippines.

DENR/UNDP (Department of Environment and Natural Resources and United Nations Development Programme). 1997. Philippine master plan for marine and coastal environment. Coastal Environment Program, DENR, Quezon City, Philippines.

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001. Philippine coastal management guidebook no. 8: Coastal law enforcement. Coastal Resource Management Project of the Department of Environment and Natural Resources, Cebu City, Philippines. 164 p.

EPA (Environmental Protection Agency). 1992. Principles of environmental enforcement. Office of Enforcement, EPA, Washington, DC, USA.

Galvez, R., T.G. Hingco, C. Bautista and M.T. Tungpalan. 1989. Sociocultural dynamics of blast fishing and sodium cyanide fishing in two fishing villages in the Lingayen Gulf area, p. 43-62. *In* G. Silvestre, E. Miclat and T.E. Chua (eds.) Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines. ICLARM Conf. Proc. 17, 200 p.

Green, S.J., R.D. Alexander, A.M. Gulayan, C.C. Migrino III, Jarantillo-Paller and C.A. Courtney. 2002. Bohol Island: Its coastal environment profile. Bohol Environmental Management Office and Coastal Resource Management Project, Cebu City, Philippines.

Israel, D.C. and C.P. Banson. 1996. Empirical estimation of overfishing in the Philippine commercial fisheries sector. Development Academy of the Philippines, Pasig City, Philippines.

Oposa, A. 1999. Enforcing coastal laws. Paper presented at the First Conference of Coastal Municipalities, League of Municipalities of the Philippines, 29 May 1999, Manila, Philippines. (Unpublished).

Pal, I.F.B. and C. Zarcadoolas. 2002. Interplay of perception, culture and mass media in the enforcement of Philippine coastal and fishery laws. Univ. Philipp. - Visayas J. Nat. Sci. (1/2): 214-222.

Trinidad A.C., R.S. Pomeroy, P.V. Cruz and M. Aguero. 1993. Bioeconomics of Philippine small pelagic fishes. ICLARM Tech. Rep. 38, 74 p.

White, A.T. and A. Cruz-Trinidad. 1998. The values of Philippine coastal resources: Why protection and management are critical. Coastal Resource Management Project, Cebu City, Philippines.

Evidence for Fishery Enhancement Effects of Marine Reserves in Central Philippines[1]

ANGEL C. ALCALA[2]
GARRY R. RUSS[3]
AILEEN P. MAYPA[2]
[2]*Silliman University-Angelo King Center for Research and Environmental Management*
Dumaguete City
Philippines
[3]*School of Marine Biology and Aquaculture*
James Cook University
Townsville, Queensland 4811
Australia

Abstract

Three lines of evidence for local fisheries enhancement by marine reserves at Sumilon and Apo Islands, central Philippines are discussed. The data on catch rates and underwater census of fish density and biomass gathered at these islands during several separate years from 1976 to 2001, provide a compelling argument for adult fish export or spillover from the no-take marine reserves to fished areas in the non-reserves.

Introduction

There is reason to believe that the original peoples on Pacific islands practiced some forms of indigenous conservation methods. People on these islands periodically closed portions of reefs or whole reefs to allow fishery resources to recover after periods of exploitation. The early Filipinos also probably had some forms of coastal resource management, but accounts of their activities have been lost in history.

Marine reserves or no-take marine reserves are areas of the marine environment protected from various forms of human or extractive exploitation such as fishing. In the sense of this definition, marine reserves are synonymous to marine protected areas, marine harvest refuges, and marine sanctuaries. The areas outside reserves are referred to as nonreserves or fished areas, where small-scale fishers are allowed to fish using traditional, nondestructive fishing gears. Marine reserves vary in size, but the ideal size is thought to be about 20% of the total marine area, based on theoretical models on risk of fish stock collapse. Thus a 100-ha coral reef area should have a 20-ha marine reserve. The remaining 80-ha area, the nonreserve, is open to fishing by small-scale fishers. In practice the area of a reserve is subject to negotiation with local fishing communities, and could be bigger or smaller than 20%. There is no doubt that large reserves are preferable to small ones, since fishery and conservation benefits are directly proportional to size. But in many developing countries marine space is limited, and it may not be possible to set aside large areas of the marine environment for conservation purposes.

No-take marine reserves are now recognized as one of the best options for managing coastal and marine resources. First, they are precautionary measures against possible total collapse of fisheries. Second, they are the most viable options for fishery management and biodiversity conservation in developing nations because they are relatively easy to set up, are generally acceptable to small-scale

[1] This paper is a reprint of the full article which originally appeared as: ALCALA, A.C., G.R. RUSS and A.P. MAYPA. 2002. Evidence for fishery enhancement effects of marine reserves in Central Philippines. UPV J. Nat. Sci 7(12): 1-5.

This paper can be cited as above or as follows: ALCALA, A.C., G.R. RUSS and A.P. MAYPA. 2004. Evidence for fishery enhancement effects of marine reserves in Central Philippines, p. 215-218. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

fishers, and offer economic benefits to local communities, including enhanced fisheries and income from tourism.

There are other beneficial effects of marine reserves, but only the fishery enhancement function of reserves with the supporting evidence for spillover or export of adult fishes from reserves is the subject of this paper. Spillover was predicted in 1957 by R.G.H. Beverton and S.G. Holt in their theoretical model of enhancement of yield per recruit if fishing is confined to a small part of the area occupied by a stock.

The empirical basis for our evidence on spillover or fish export from reserves comes from our work on Sumilon and Apo Marine Reserves during the period 1974-2001. Sumilon Marine Reserve is about 0.75 km long, about 25% of the total coral reef area, established at the western side of the island in April 1974. The reserve had full protection from 1974 to 1980, but some violations began to occur in the early 1980s. The management during the succeeding years can be characterized as unstable, at times protected and at other times fished. Apo Island had originally a 0.45 km long marine reserve, about 11% of the coral reef area, but the area is being increased to about 15% at the present time. The reserve was established on the southeastern side of the island in 1982. The Apo Marine Reserve, in contrast to Sumilon Marine Reserve, has been fully protected by the local community since its establishment in 1982.

There are now more than 30 potential and actual marine reserves, including several established under our own initiative, in the 29,000 km^2 Bohol (Mindanao) Sea and the oceanographic features of this body of sea water. Only noncommercial (artisanal and subsistence) fisheries occur at both islands.

Evidence for Spillover

First piece of evidence: Sumilon Marine Reserve, 1976-2001

The yield of reef and reef-associated fish (caesionids, acanthurids and carangids 74-87% of yield) from traps at eight separate years during the 25-year period when the reserve was protected (1974-1984), 18 months after protection broke down (1985-1986), and after 14 years of unstable management (2001) showed increased yields during time of protection and decreased yield when protection ceased. There was a steady increase of fish yield from traps during the period of protection from 75% of the reef area, from 9.7 to 16.8 $t{\cdot}km^{-2}{\cdot}year^{-1}$. When protection ceased in 1984-1985, the yield from 100% of the coral reef area declined to 11.2 $t{\cdot}km^{-2}{\cdot}year^{-1}$ in 1985-1986 . The yield from traps (45% of total yield) from the whole reef in 1985-1986 was significantly less than the average yield of the nonreserve (75% of the total reef area) measured over six separate years during the period of protection (one sample t-test, $t_5 = 3.05$, $p<0.05$). After 14 years of erratic management, the annual yield further declined to 10 $t{\cdot}km^{-2}{\cdot}year^{-1}$ in 2001. The yield consisted of similar families of fish from about the same number of traps in 1974-1984 taken during 12 months in 2001.

When yields from traps and gill nets for four separate years from 1979 to 1985-1986 were pooled, a similar picture emerged (one sample t-test, $t_2=6.18$, $p<0.01$). The projected annual yield for 2001 is also lower than those in 1979, 1980 and 1983-84.

The mean CPUE ($catch{\cdot}person^{-1}{\cdot}trip^{-1}$) for the three main fishing gears (hook and line, gill net and trap) also significantly decreased from about 2.0 kg during the period of protection in 1983-1984 to about 1.0 kg over a one-year period in 1985-1986, after 18 months had elapsed following cessation of protection.

The results of the underwater census of the caesionids (which comprised more than 60% of the catch) in the reserve and nonreserve are generally consistent with the export of adults to the nonreserve. The mean density of this group was higher in the reserve in 1983 (when protection was in place) than in 1985 (when protection was lifted). The mean density was lower in the nonreserve in 1983 and 1985 than in the reserve in 1983 (but with broader range in 1983). The low mean density in the nonreserve in 1985 might be explained by reduced export from the reserve. This argument is merely suggestive in view of the low mean density in the nonreserve in 1983 before the lifting of protection.

We attribute the fishery enhancement during the period of protective management of Sumilon Reserve to the spillover of adult fishes from the reserve to the non-reserve, where fishers caught them.

The finding that fishers get more fish from 75% of the reef area when protected than from 100% of the area when not protected appears contrary to common sense. Two British fishery scientists, R.J.H. Beverton and S.J. Holt, in 1957, provided a theoretical explanation: at high levels of fishing mortality, closing an area to fishing can enhance yield per recruit.

Second piece of evidence:
Apo Marine Reserve, 1983-1993

Underwater census over a period of 10 years at Apo has provided evidence for spillover from the reserve. This is supplemented by the local fishers' unanimous assessment that their fish catches from the nonreserve had increased during the period. The density of large predatory fishes at different distances from Apo reserve boundary during the first eight years of protection (four sampling periods pooled) and the last three years of protection (three sampling periods pooled) was highest in fished areas closest to the reserve. The data provide evidence for the export of adult fishes from the reserve to the fished areas.

The next step is to determine the CPUE of fishers fishing at various distances from the boundaries of the reserve. Such data should complement the underwater fish census data to demonstrate adult fish export from the reserve.

Third piece of evidence:
Apo Marine Reserve, 1981-2000

The reserve showed an increasing trend from 1983 to 2000. There was a threefold increase in biomass during this 17-year period. The biomass in the control sites in the nonreserve also showed an increasing trend, though less pronounced. Most of this increase of biomass at the Apo nonreserve occurred at the site closer to (200-300 m) than farther away (400-500 m) from the boundary of the Apo reserve. This pattern of having more fish nearer the reserve did not appear until the last decade of sampling. The next step to confirm the outward movement of fish is to show the same trend in fish catch.

Over time there has been an increasing proportion of acanthurids and carangids in the fish catch at Apo nonreserve, but the total catch of these two fish groups remained remarkably constant. During the same period (1981-2000), the catch rates of hook-and-line fishers increased. Carangids, which are reef associated, and acanthurids (genera *Naso* and *Acanthurus*), which are reef fishes, are caught mostly by hook-and-line. They have been always observed on Apo reef, both in reserve and nonreserve. Fishers at Apo have largely abandoned the use of gill nets and bamboo traps as fishing gears since the latter half of the 1990s, and now depend largely on hook-and-line. Moreover, they fish in the vicinity of coral reefs. In this way they realized savings through reduced fishing effort and expense. One significant factor that contributed to the reduced fishing effort has been the tourism activities, which flourished as a consequence of the protection of the island's marine biodiversity by the local community. Tourism has been a source of income for this community.

Most of the fish catch at Apo in 2000 belonged to Carangidae, Acanthuridae and Caesionidae, the same families that dominated the catch in the previous years.

All of the above findings constitute the third piece of evidence for the fish spillover effect of the Apo Marine Reserve.

Other Studies

Other studies have tended to show this spillover effect for spiny lobsters in Florida (Davis 1977), snow crabs in Japan (Yamasaki and Kuwahara 1990), and sport fishes in Florida (Johnson *et al.* 1999). A study using acoustic telemetry (tracking) by C. Mayer of the University of Hawaii has demonstrated that fish (a mullid and a carangid) frequently ranged beyond reserve boundaries.

Conclusion

Although the three pieces of evidence do not unequivocally demonstrate net export or spillover of post-settlement fish, as this demonstration requires the use of the Before-After-Control-Impact-Pair Design, our evidence is a compelling argument for the spillover effect of marine reserves. The three pieces of evidence took 10-25 years of study. Our long-term study is continuing and involves four more sites in central Philippines. Our aim is to demonstrate unequivocally that spillover from fully protected marine reserves occurs and enhances fisheries of areas adjacent to reserves. The importance of this demonstration is that it is needed to convince fishing communities to accept the idea of marine reserve establishment.

Bibliography

Alcala, A.C. 2001. Marine reserves in the Philippines: Historical development, effects and influence on marine conservation policy. Bookmark, Makati. Philippines. 115 p.

Alcala, A.C. and G.R. Russ. 1990. A direct test of the effects of protective management on abundances and yield of tropical marine resources. J. Cons. CIEM 46: 40-47.

Davis, G.E. 1977. Fishery harvest in an underwater park. Proceedings of the Third International Coral Reef Symposium 2: 605-608.

Johnson, D.E., Funicelli,A. and Bohnsack, J.A. 1999. Effectiveness of an existing estuarine no-take fish sanctuary within the Kennedy Space Center, Florida. N. Am. J. Fish. Manage. 19: 436-451.

Maypa, A.P., A.C. Alcala, and A.C. Russ. Impacts of long-term protection of a marine reserve on fish yields of Apo Island, central Philippines. Paper presented at the Sixth Indo-Pacific Fisheries Conference, May 2001, Durban, South Africa.

Russ, G.R. 2001. Marine reserves as reef fisheries management tools: Yet another review. *In* P.F. Sale (ed.) Coral reef fishes: New insights into their ecology. Academic Press, USA.

Russ, G.R. and A.C. Alcala. 1996. Do marine reserves export adult fish biomass? Evidence from Apo Island, Central Philippines. Mar. Ecol. Prog. Ser. 132: 1-9.

Russ, G.R. and A.C. Alcala. 1999. Management histories of Sumilon and Apo marine reserves, Philippines, and their influence on national marine resource policy. Coral Reefs 18: 307-319.

White, A.T. and H. Calumpong. 1992. Summary field report. Saving Tubbataha Reef. Monitoring marine reserves in the Central Visayas. Earthwatch Expedition, Philippines, April-May 1992, 24 p. (Unpublished).

Yamasaki, A. and A. Kuwahara. 1990. Preserved area to effect recovery of overfished Zuwai crab stocks off Kyoto Prefecture, p. 575. *In* Proceedings of the International Symposium on King and Tanner Crabs, Alaska Sea Grant College Program, University of Alaska, Fairbanks, Alaska, USA.

Marine Protected Areas[1]

PORFIRIO M. ALIÑO[3]
HAZEL O. ARCEO[2]
ANDRE J. UYCHIAOCO[2,3]
[2]*Marine Science Institute, University of the Philippines*
Diliman, Quezon City 1101
[3]*Bolinao Marine Laboratory, University of the Philippines*
Brgy. Guiguiwanen, Bolinao, Pangasinan 2406
Philippines

Definition and Purposes of Marine Protected Areas

"Marine protected area" (MPA) is a general term used to refer to areas of the sea protected whether by law and/or in fact from one or more activities. There are many kinds of MPAs, and there is no consensus on the definitions of the various terms used to refer to them (e.g., no-take zones, sanctuaries, reserves, harvest refugia, parks, etc.). Marine fishery reserves refer to MPAs protected from fishing and/or protected for the benefit of fisheries. Fully protected marine reserves are areas of the sea completely protected from fishing and other extractive or harmful human uses (Roberts and Hawkins 2000). No-take marine reserves are protected from fishing and other extractive use but not necessarily from harmful nonextractive use.

MPAs restrict harmful activities to protect ecosystem values (e.g., spawning and nursery grounds of fishery stocks). Zones are defined in some MPAs to reduce conflicts between incompatible uses by geographically separating conflicting uses (Figure 1).

Fully protected marine fishery reserves can prevent loss of, and restore, fishery productivity even as they facilitate habitat protection and recovery. Since fishing often targets the larger individuals in a population, no-take MPAs result in stocks with larger individuals. In fully protected marine reserves, individuals that would have otherwise been harvested will also be able to grow in size and number. Higher densities of mature individuals result in higher frequency of mating and reproductive success. In addition, larger fishes grow slowly but invest heavily on production of eggs, so that fecundity tends to increase with size (Edwards 1984 in Roberts and Polunin 1991). Thus, larger individuals produce disproportionately more young, so MPAs result in more young fish and so more fish overall. Once adults increase inside, crowding and the search for food will also drive some outside where they can boost catches —this is called "spill-over". Currents will also disperse young produced by large adults in the reserve to populate other places. Thus, while there are short-term losses of fishing ground, MPAs result in net benefits that may be more sustainable over the long term.

Moreover, MPAs require less information to set up, are less expensive and simpler to implement and enforce than catch quotas, size limits and gear restrictions. Nonetheless, MPA setup will still require identification of nursery grounds, spawning grounds or areas of particular stock vulnerability, and will also require information campaigns and political lobbying. MPAs also protect habitats/ecosystems in addition to fishery protection, enhancement and sustainability. However, MPAs are not stand-alone solutions; they must be embedded in and/or used in conjunction with other coastal management interventions. For example, they are also ideal sites for stock enhancement since reseeded propagules in areas without sufficient protection may be easily decimated.

Then and Now

MPAs in the Philippines have been reviewed by Gomez *et al.* 1984; Alcala 1988; White 1988; Bleakley and Wells 1995; DENR-PAWB/UNEP 1997; Pajaro *et al.* 1999; Aliño *et al.* 2002; UPMSI *et al.* 2002.; and White *et al.* 2002. The Philippines is probably the Southeast Asian nation with the most number of MPAs legally established (UPMSI *et al.* 2002) with 439 and many

[1] This paper can be cited as follows: ALIÑ0, P.M., H.O. ARCEO and A.J. UYCHIAOCO. 2004. Marine protected areas, p. 219-222. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

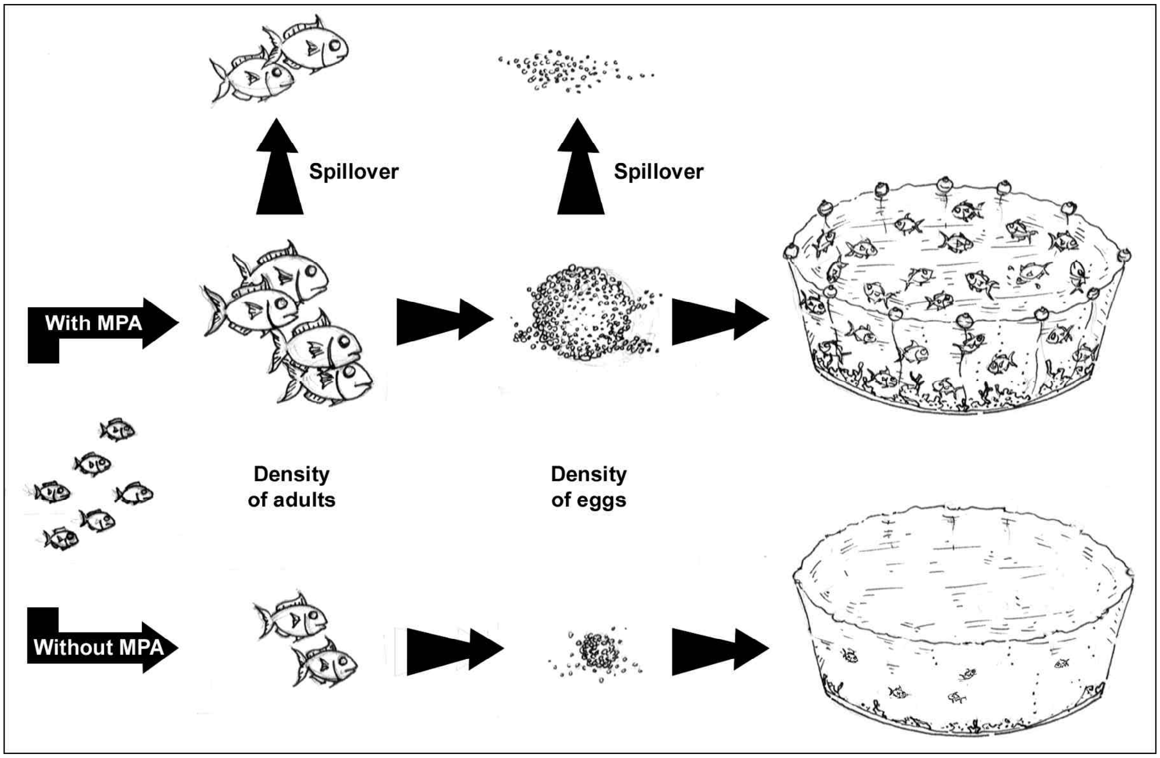


Figure 1. MPAs allow fish to grow in size and number and result in more eggs and young fish.

others being proposed (Pajaro *et al.* 1999).

The Hundred Islands National Park, although not declared as a marine park per se, is the Philippines' first national park with a significant marine component (Gomez *et al*. 1984). It was declared through Presidential Proclamation (PP) 667 in 1940 and later reinforced by Presidential Decree 564. The park is managed by a multisectoral Protected Area Management Board led by the Philippine Tourism Authority and the municipal government of Alaminos. The Sumilon Marine Reserve and the Apo Island Marine Reserve established in 1974 and 1985, respectively, are among the nation's earliest fishery reserves. Tourist zones and marine reserves throughout the country were legislated by PP 1801 in 1978 but have not been implemented as such because the law is very general. Sixteen wilderness areas (mangrove swamp forest reserves) were established by PP 2151 and 27 mangrove forest reserves by PP 2152, both in 1981. The United Nations Educational, Scientific and Cultural Organization (UNESCO) declared Puerto Galera a Biosphere Reserve in 1977 and Tubbataha Reefs a World Heritage Site in 1993 (originally established by PP 306 in 1988). Tubbataha is also within the Palawan Biosphere Reserve (inscribed by UNESCO in 1990).

The Local Government Code (Republic Act [RA] 7160) of 1991 entrusted responsibility over the environment and natural resources from the national government to local government units including empowering municipal/city legislative bodies to establish MPAs within municipal/city waters through municipal/city ordinances. The National Integrated Protected Areas System (NIPAS) Act (RA 7586) in 1992 provided a common framework for national parks and a protected areas system. The NIPAS Act also provided for the development of 10 high-priority protected areas, including the Turtle Islands Heritage Protected Area, Siargao Island Protected Landscapes and Seascapes, Batanes Protected Landscapes and Seascapes, and Apo Reef Marine Natural Park. A similar effort, the National Integrated Protected Areas Project, adopted two marine areas in Palawan, i.e., El Nido Marine Reserve and Malampaya Sound. Section 81 of the Fisheries Code (RA 8550) of 1998 provides for the designation of at least 15% of municipal waters for fish refuges or sanctuaries and allows 25-40% of fishing grounds to be established as mangrove reserves. Recently, Section 25 of the Wildlife Resources Conservation and Protection Act (RA 9147) of 2001 provided for the protection of habitats critical to threatened species; the implementing rules and regulations for the Wildlife Act are being drafted.

Only around 10-13% of MPAs in East Asia are considered effective (Bleakley and Wells 1995). In the Philippines, management levels are generally

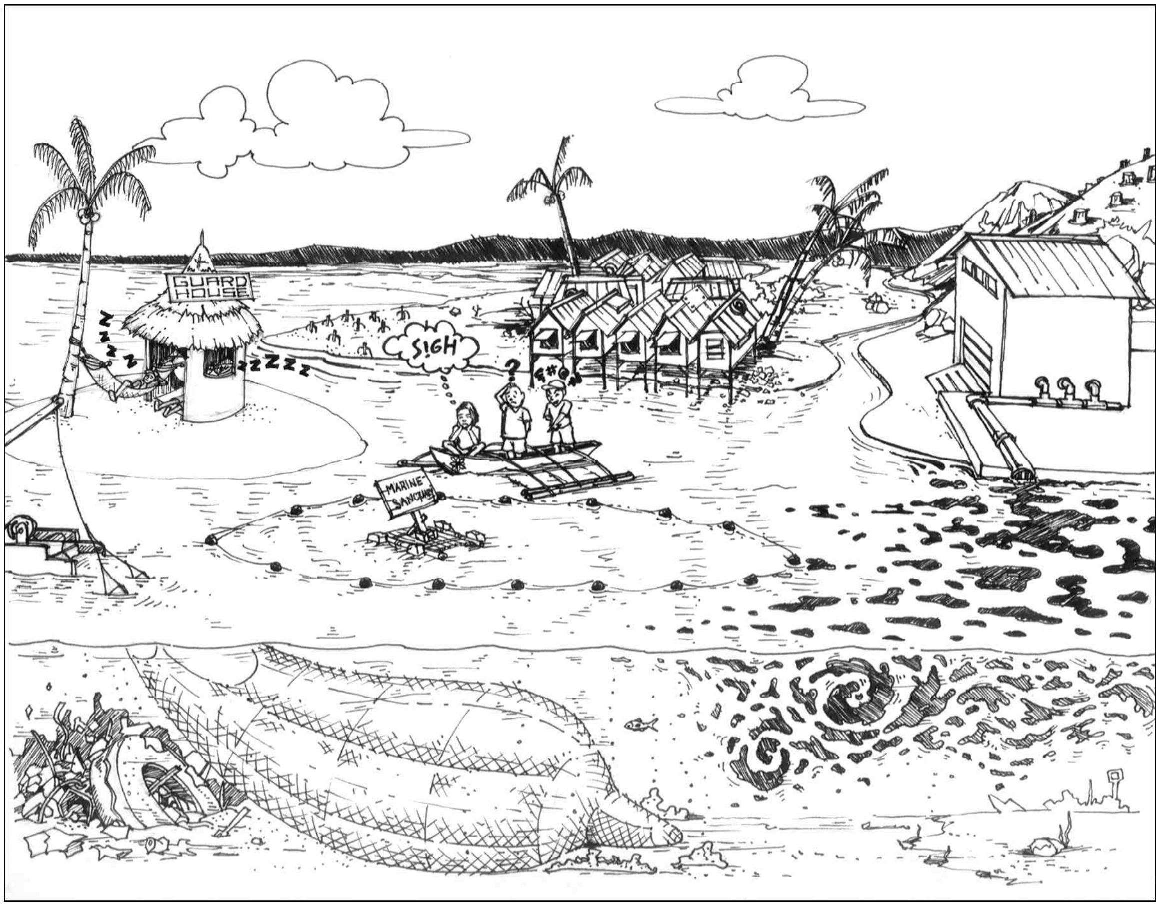


Figure 2. Following the establishment of an MPA, people may unrealistically expect the speedy recovery of fish stocks even as pollution, intrusion of fishers, overfishing and other threats have yet to be controlled.

considered to be "low" (Bleakley and Wells 1995) with around 16-38% of Philippine MPAs deemed strictly enforced (Pajaro *et al.* 1999).

Generally, only a small fraction of the nation's coral reefs are being managed adequately, the rest are under heavy stress. Community-based management, while sometimes very effective, continues to be successfully implemented only in very small areas. In the last few years, local community organizations managing MPAs were assisted by the Haribon Foundation in organizing themselves into a national alliance called the Pambansang Alyansa ng Maliliit na Mangingisda at Komunidad na Nangangalaga ng Karagatan at Sanktuwaryo sa Pilipinas (PAMANA). Management in conjunction with local government (including coastal law enforcement) continues to rapidly gain ground but its conservation effectiveness is not evident in most areas except for a few exemplary ones like Apo Island.

Constraints and Lessons

Problems often arise when there is lack of public understanding and support, weak enforcement arrangements, lack of sustainable financing, unclear jurisdiction, roles and accountability for the implementation of MPA, unclear hierarchy of objectives (e.g., environmental integrity / sustainability and increased catch / income), adjacent stresses (e.g., pollution or siltation), and disappointments with respect to unrealistic expectations of the rate of biomass buildup (see Figure 2).

Key lessons learned for effective MPAs are as follows (modified and expanded from Roberts and Hawkins 2000):

1. MPAs' objectives should be stated clearly and management should be explicitly designed to achieve such objectives.
2. Generally, 6-20 ha of coral reefs have not been sufficient, rather 10-15% of the area to be managed should be targeted for intensive protection and management.
3. All MPAs need a management plan. The establishment and management of an MPA that work in one area may not work in others. MPA effectiveness can be improved and should be monitored and evaluated. MPA plans need to be

regularly evaluated and adjusted.

4. The involvement of local stakeholders from planning to management (including enforcement and monitoring and evaluation) is critical and hence, must be encouraged. Active multisectoral participation in MPA management tends to be more sustainable.
5. MPAs should be established within an integrated coastal management framework. MPAs should be combined and integrated with other management strategies.
6. An imperfect reserve is better than no reserve at all. However, be careful not to raise undue expectations.
7. MPAs allow us to employ the precautionary principle (Lauck *et al.* 1998).
8. The objective of increased catch and income must always be kept in mind.
9. Financial sustainability is essential for MPAs to last and must be planned for.

Opportunities and Next Steps

Planning and managing networks of MPAs (e.g., wherein distances between MPAs are proportional to the MPA sizes, e.g., 10 km between 0.5-1.0 km^2 reserves) enable individual MPAs to provide sources of fish young to each other. This renders MPAs in the network more robust to stress.

No-take MPAs that have been established and are being established are often based on the Apo Island model. Since it is a small island, MPAs based on that model are often too small. Rather, as a rule of thumb, 10-15% of the area to be managed should be protected (e.g., by the village or municipality).

In the last 30 years, MPAs protecting large areas of coral reefs were mainly established by PP 1801 in 1978 and NIPAS initiatives from 1993 to the present. Numerous but mostly tiny areas of coral reefs were protected by local government legislation from 1992 to the present. Considering these, we estimate that it will take around 100 years before we have protected (at least by legislation) 5,000 km^2 or 10% of the Philippines' coral reefs. Consider also that at the same time this is done, there are many other reef areas that are being destroyed. Since it has been estimated that in only 10-38% of reefs protected by legislation that protection is enforced, it will actually take around 300-1,000 years before 10% of Philippine reefs shall have been effectively protected. Thus, in conjunction with protecting more areas, we must also be improving the effectiveness of our management.

References

Alcala, A.C. 1988. Effects of marine reserves on coral fish abundances and yields of Philippine coral reefs. Ambio 17(3): 194-199.

Aliño, P.M., N.E. Palomar, H.O. Arceo and A.J. Uychiaoco. 2002. Challenges and opportunities for marine protected area management in the Philippines. *In* Proceedings of the Ninth International Coral Reef Symposium, Bali, Indonesia.

Bleakley, C. and S. Wells. 1995. East Asian Seas. *In* G. Kelleher, C. Bleakley and S. Wells (eds.) A global representative system of marine protected areas. Vol. 3. World Bank, Washington, DC, USA.

DENR-PAWB/UNEP (Department of Environment and Natural Resources-Parks and Wildlife Bureau/United Nations Environment Programme). 1997. National Biodiversity Assessment and Action Plan. DENR-PAWB, Quezon City, Philippines, and UNEP.

Gomez, E.D., R.T. Biña and C.A. Rodriguez. 1984. Marine parks in ASEAN countries. Proc. 1st ASEAN For. Congr. 3(6): 811-820.

Lauck, T., C.E. Clark, M. Mangel and G.P. Munro. 1998. Implementing the precautionary principle in fisheries management through marine reserves. Ecol. Appl. 8 (Suppl.): S72-S78.

Pajaro, M., F. Olano and B. San Juan. 1999. Documentation and review of marine protected areas in the Philippines: A preliminary report. Haribon Foundation for the Conservation of Nature, Quezon City, Philippines.

Roberts, C.M. and J.P. Hawkins. 2000. Fully-protected marine reserves: A guide. World Wide Fund for Nature Endangered Seas Campaign, Washington, DC, USA, and Environment Department, University of York, York, UK.

Roberts, C.M. and N.V.C. Polunin. 1991. Are marine reserves effective in management of reef fisheries? Rev. Fish Biol. Fish. 1: 65-91.

UPMSI/ABC/ARCBC/DENR/ASEAN (University of the Philippines-Marine Science Institute/Asian Bureau for Conservation/ASEAN Regional Center for Biodiversity Conservation/Department of Environment and Natural Resources/Association of Southeast Asian Nations). 2002. Marine protected areas in Southeast Asia. UPMSI/ABC/ARCBC/DENR/ASEAN, Laguna, Philippines. 142 p. and 10 maps.

White, A.T. 1988. Marine parks and reserves: Management for coastal environments in Southeast Asia. ICLARM Educ. Ser. 2, 36 p.

White, A,T., A. Salamanca and C.A. Courtney. 2002. Experience with marine protected area planning and management in the Philippines. Coast. Manage. 30: 1-26.

Marine Protected Areas: Urgent Call for an Offshore Marine Sanctuary under Republic Act 8550[1]

RUDOLF HERMES
Visayan Sea Coastal Resources and Fisheries Management Project
Bureau of Fisheries and Aquatic Resources-
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
Iloilo City 5000
Philippines

The establishment of marine protected areas (MPAs) in certain portions of municipal waters has become a major component of coastal resource management initiatives in various parts of the Philippines. Common goals of this activity are the rehabilitation of critical (e.g., coral reef) habitats, replenishment of fish resources, and to a lesser degree, promotion of tourism or recreation. The active participation of the adjacent community in the planning, implementation and monitoring process is considered an important characteristic and major factor in the eventual success of MPA establishment.

Municipal waters are under the jurisdiction of the respective local government unit (LGU) as mandated by the Local Government Code of 1991. Coastal cities or municipalities have the task and responsibility to manage these waters through ordinances and other regulatory measures. Thus, a municipality may establish a MPA through a local ordinance. Another established process for protected area management is through the National Integrated Protected Areas System Act (Republic Act [RA] 7586), usually under its category of "protected landscape / seascape". Under this scheme, the Department of Environment and Natural Resources (DENR) assumes the leadership through the formation of a Protected Area Management Board with the participation of respective LGUs and in consultation with the community.

The Fisheries Act of 1998(RA 8550) is another important legal basis for the establishment of municipal MPAs. Section 81 – Fish Refuge and Sanctuaries – states that LGUs may establish these in consultation with the respective Fisheries and Aquatic Resources Management Councils and the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR). The same section of the code provides the basis for the establishment of MPAs (fish refuge and sanctuaries, where all commercial fishing is prohibited) through DA-BFAR *outside of municipal waters*. Section 80 - Fishing Areas and Reserves for Exclusive Use of Government – refers explicitly to *areas beyond 15 km from the shoreline*, where utilization (exploitation) can be restricted to government agencies (e.g., for propagation or scientific purposes). Five years after the enactment of RA 8550, this option has not yet been exercised, probably due to a lack of well-justified proposals, the present focus on inshore coastal waters and the problems in monitoring offshore areas.

However, given the overfished status of many Philippine fishing grounds, it is urgent and advisable to declare MPAs also in offshore waters for the rehabilitation of economically important fish stocks and to exclude commercial fishing from certain areas. These are usually portions of bays and gulfs beyond 15 km which are too small to render legal commercial fishing practically and economically feasible. If commercial fishing is taking place in such areas, it almost automatically leads to encroachment into municipal waters, and this cannot be prevented without unreasonably expensive enforcement efforts.

Areas of this nature, i.e., where municipal waters of opposing coastal LGUs leave only little space in between, are numerous due to the archipelagic nature of the country. They include central portions of Lingayen Gulf, Manila Bay, Ragay Gulf and Tayabas Bay, among others. Suitable central portions of large water bodies like these should be considered as reserves or sanctuaries when enforcement (patrolling)

[1] This paper can be cited as follows: HERMES, R. 2004. Marine protected areas: Urgent call for an offshore marine sanctuary under Republic Act 8550, p. 223-225. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

capabilities have been strengthened and compliance has improved. Management systems under the responsibility of DA-BFAR should be devised, tested and applied.

There are certain smaller areas where conservation efforts under RA 8550 (i.e., outside municipal waters), can be implemented almost immediately. A case in point is the Maca Shoal in the Visayan Sea (Figure 1). The shoal has an area of approximately 20 km^2 and is located at latitude 11º06'N and longitude 123º27'E about 15-20 km north of the coast of Negros Island. Its shallow portions are less than 2 m deep. Surrounding waters have a depth of 40-50 m. At this shoal, the outer limits of the respective municipal waters of Concepcion, Iloilo; Bantayan, Cebu; and Sagay City, Negros Occidental, as determined by the National Mapping and Resource Information Authority under DENR DAO 17, almost touch, but leave a relatively small triangular area of approximately 15 km^2 of open water in between, which coincides largely with the Maca Shoal. This area is entirely enclosed by municipal waters and not connected to the central commercial fishing ground of the Visayan Sea further to the north. A rapid survey of the area should be done to verify that it consists of a critical habitat worth protecting and that it harbors fishery resources, as would be expected of shoals. Based on the analysis and interpretation of the resource and habitat information, the MPA establishment process should be initiated.

Management responsibility for this area should be assumed jointly by BFAR Regional Office 6 (Iloilo) and 7 (Cebu) - both are cooperating in the BFAR-GTZ Visayan Sea Coastal Resources and Fisheries Management Project (VisSea) - with support from appropriate enforcement agencies such as the

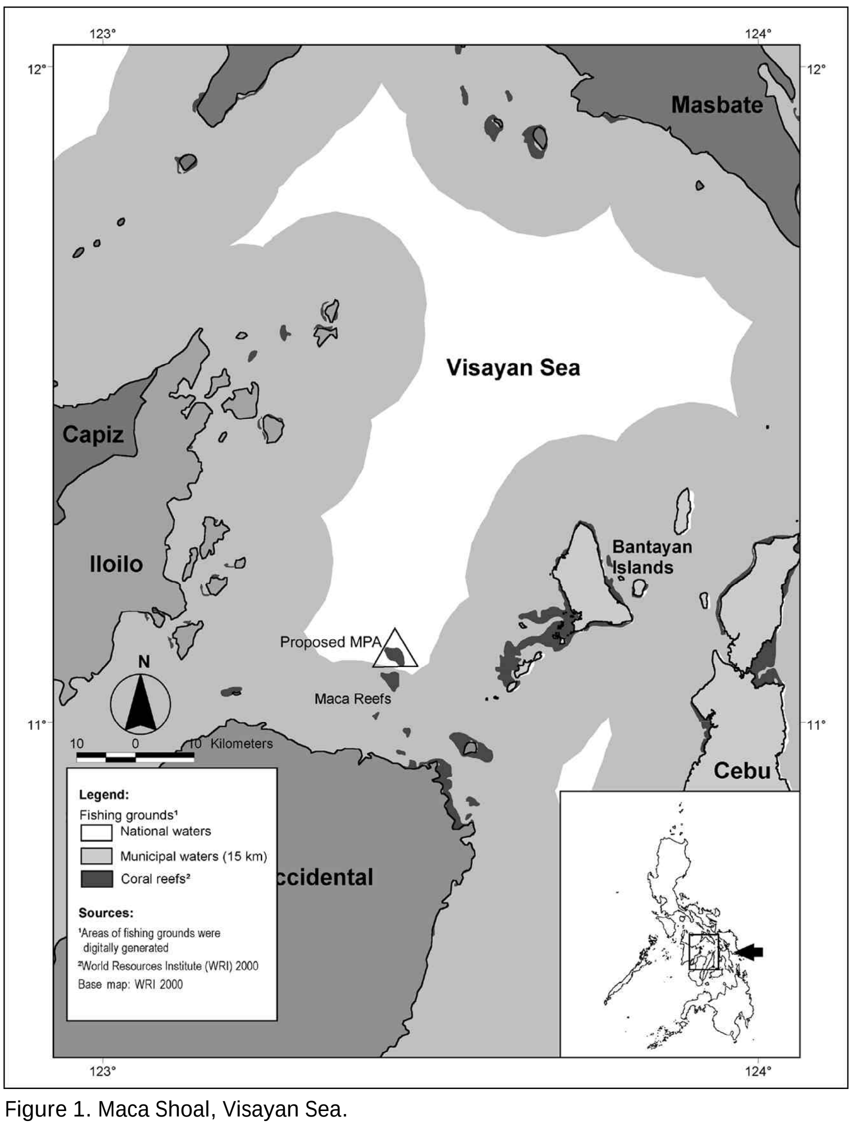


Figure 1. Maca Shoal, Visayan Sea.

Philippine Coast Guard. The management task should be shared with Sagay City LGU, the well-established marine reserve which is situated towards the south, contiguous to the proposed area. Some monitoring and enforcement duties could be delegated to this LGU, while broader participation should be mobilized within the community and also in others whose members use the area of Maca Shoal as their traditional fishing ground (e.g., Bantayan Island, Cebu). These efforts to promote and include community-based approaches in the establishment of an offshore MPA need to be accompanied by intensive information and education initiatives, focusing on the reasons for its establishment and the expected benefits to resource users.

The management of Maca Shoals MPA, which would be the first to be established outside municipal waters solely under the authority of RA 8550, could serve as a model for the promotion of future offshore MPAs which are required to conserve and replenish depleted Philippine fish stocks.

Management Rating System for Marine Protected Areas: An Important Tool to Improve Management[1]

ALAN T. WHITE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

ANNA T. MENESES
MELODY F. OVENDEN
Marine Protected Area Project
Coastal Conservation and Education Foundation, Inc.
3rd Floor, PDI Condominium
Banilad, Cebu City
Philippines

The Need to Improve Marine Protected Area Management

In 1974, the first municipal marine protected area (MPA) was declared in Sumilon Island. In the 1970s, there were very few recorded MPAs in the Philippines. Over the years, more MPAs were established. To date, about 439 MPAs have been legally established throughout the Philippines (Pajaro *et al.* 1999). Despite the numbers, most are merely "paper parks" with a design and perhaps an official declaration, but lacking in applied sustainable management strategies. It is estimated that only about 10% of existing MPAs are actually achieving habitat protection (Pajaro *et al.* 1999; White *et al.* 2002). The growth in the number of MPAs has increased the need for effective management tools that involve devolution of authority from central to local governments, as well as support of public and private institutions to train local governments and communities in MPA planning and management (DENR *et al.* 2001; White *et al.* 2002).

In rural Philippines, conservation efforts are not a high priority compared to food security. Thus, the increase in fish yields that eventually results from MPA establishment is a tangible benefit that should be emphasized to obtain support from local stakeholders. In this context, MPAs are valued as a means to ensure the food needs of coastal communities while also aiding in protection of the marine environment.

Establishing MPAs is now one of the key strategies of integrated coastal management (Salm *et al.* 2000). The accepted objectives for establishing them in the Philippine context are to (Roberts and Hawkins 2000; White *et al.* 2002):

1. protect and enhance marine biological diversity and marine habitats;
2. sustain and increase fishery yields;
3. reduce resource use conflicts;
4. provide a simple and easy way to enforce conservation;
5. encourage community participation and empowerment in planning and management; and
6. provide areas for ecotourism, environment-friendly enterprise, scientific research, public education and cultural diversity.

Since most MPAs face difficulty in enforcement and implementation due to poverty and a general lack of awareness about the coastal environment, a system is needed to improve the overall quality of management. A malfunctioning MPA is a loss of opportunity to protect and conserve resources, as well as a loss of economic benefits to local communities.

[1] This paper can be cited as follows: WHITE, A.T., A.T. MENESES and M.F. OVENDEN. 2004. Management rating system for marine protected areas: An important tool to improve management, p. 226-231. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Marine Protected Area Report Guide and Management Rating System

There are a growing number of cases where MPAs are able to sustain management operations for habitat and species protection. Building on these successes of MPAs in the Philippines, the development of the MPA management rating system through the MPA Project[2] highlights the need and means to increase the number of well-managed MPAs. The MPA management rating system, initiated in 2001, is evolving through the practical application and participation of multiple partners. The MPA Project is providing a means to improve and standardize MPA monitoring in the country by assisting implementation through recommendations based on findings and lessons learned from research, field interventions and application of the management rating system. It is developing and testing a national system to evaluate the effectiveness of MPAs while establishing an MPA database that is shared and updated with the objective of centralizing information on MPAs and making it available for use in decisionmaking by MPA managers. The marine protected coast, reef and management database (MPA database), also initiated in 2001, will be fully operational in 2004 and is accessible through the website, www.coast.ph, and participating nongovernment and government partners.

The management rating system is designed to aid MPA managers in evaluating their performance in terms of management, implementation and enforcement (Table 1). Once applied, it shows the priorities for improved management and provides feedback to the community and other levels of management.

At present, there are 160 MPAs recorded in the MPA database, and it is still a work in progress. Some 36% of these have been rated according to the MPA management rating system: 66% are found in the Visayas; 22%, Luzon; and 12%, Mindanao. Most MPAs are still in the beginning stages of implementation (Table 2).

Effective management and visible changes in the utilization of resources are some of the benchmarks of change monitored in the system. In the Philippines, assuming that a community-based management strategy is the most effective in achieving a fully functional MPA, an important success factor is community empowerment and local enterprise development. In this regard, the rating system measures end benefits of MPA establishment as well as the level of community and local government participation in the planning and implementation of MPA plans and laws. The MPA guide helps all concerned to recognize weaknesses in an MPA and what is needed to improve effective management. The management strategies being utilized around the country to implement MPAs vary tremendously. The database shows a breakdown of leading organizations initiating or managing MPAs (Table 3).

MPAs in the Visayas managed by local governments and people's organizations are more advanced compared to MPAs in other regions. Most of these MPAs practice community-based resource management and collect users' fees. These are effective strategies that help sustain management and enforcement of MPAs through time. There are 10 MPAs in the Visayas imposing the collection of users' fee, only 2 in Luzon and none in Mindanao. Penalties are also being imposed by 13 MPAs in Visayas, 5 in Luzon and 1 in Mindanao.

The majority of sanctuaries recorded are relatively small (Table 4). From 142 MPAs with size information, about 15% are less than 6 ha and 56% are between 6 and 50 ha. The smallest MPA size recorded is 1 ha (Nalayag Point Fishery Refuge and Sanctuary in Batangas) and the largest is 1,822 ha (Gasan Community Marine Reserve in Marinduque). However, there are also larger MPAs that are classified as marine parks and seascapes under the national integrated protected areas system (NIPAS Act). Examples are the Tubbataha Reef National Marine Park in Palawan (33,200 ha) and Apo Reef Natural Park in Mindoro (27,469 ha).

Strategies and Lessons Learned

The MPA Project has signed a Memorandum of Agreement with six government agencies, five academic institutions and seven nongovernment organizations (NGOs) with interest in environmental conservation and resource management in coastal areas. This agreement encourages collaborative efforts among various groups to work together towards coastal and marine conservation in the country. Collaboration will be crucial for long-term adoption of the MPA system nationwide and to the application of the rating system so that managers and supporters

[2] The MPA Project is a three-year project of the Coastal Conservation and Education Foundation, Inc., supported by a grant from the Pew Fellows Program in Marine Conservation. Started in 2001, the project has the overall goal of improving the management and conservation of coral reef ecosystems through MPAs in the Philippines, with the subsequent view of a wider application in the Asia-Pacific region.

Table 1. MPA management rating system.[a]

The rating level achieved is limited by the number of years the MPA is in existence.
The MPA rating system is intended to assist local governments and communities to improve the management of their MPA. This simple rating system is dynamic and is not a definitive statement on the status of any MPA rated.

Name of MPA: ____________________

Level I: MPA Initiated: Passing (year 1) (6 points required)

Criteria or activity satisfied	**0/1**
Site selected	
Site surveyed with baseline assessment complete *(Reports available on fish abundance, coral substrate and information on issues and concerns)*	
Education program started *(Conducted at least two types of MPA-related trainings/orientation for the affected barangay/s)*	
Social acceptance sought *(Consulted members of the affected barangay/s: fishers, resource users and social groups, both men and women)*	
Management body membership tentatively determined *(The identified management body had met at least twice regarding the MPA.)*	
Preliminary management plan drafted	

Level II: MPA Established: Fair (year 1 or 2) (12 points required)

Criteria or activity satisfied	**0/1**
Acceptance approved and documented by community *(Documented either through barangay resolution or signature campaigns as well as documentation of public consultations/meetings)*	
Education program raising awareness about MPA benefits *(Conducted at least four documented information, education and communication activities regarding MPAs with participation of affected barangay/s)*	
Management body formally organized and recognized *(Management group has legal mandate from or is recognized by local government)*	
Management plan adopted by community and local government unit (LGU) or Protected Area Management Board (PAMB) *(Management plan initially implemented and/or endorsed by LGU/PAMB)*	
Ordinance approved by municipal council	
Anchor buoys, marker buoys and/or boundary marks installed	
Management activities started *(Conducted at least two MPA-related activities, such as maintenance of buoys, patrolling, apprehension of violators, implementation of user's fees, etc.)*	

Level III: MPA Enforced: Good (year 1 or 2) (20 points required)

Criteria or activity satisfied	**0/1**
Sanctuary rules and/or management plan posted at strategic locations	
Education program increased awareness about MPA functions/benefits *(Conducted at least five trainings for capacity-building and community empowerment with representation from fishers, resource users and social groups, both men and women. Process should be documented)*	
Biophysical monitoring measuring habitat condition and changes *(Documented surveys at least once after the baseline assessment, using standard/accepted method)*	
Patrolling and surveillance conducted *(At least three fish wardens on rotation assigned to guard and patrol the area during the day and night)*	

Table 1 (cont.)

[a]This management rating system evolved from the work of the Coastal Resource Management Project team of Negros Oriental (William Ablong and Erwin Dolumbal), with assistance from Alan White, in January 2001.

Table 1 (cont.)

Marker and/or anchor buoys maintained *(Budget allocated for maintenance of buoys; can be part of or an item within the municipal coastal resource management budget)*	
MPA outpost or other structures constructed *(Guardhouse and/or other MPA-related structures constructed)*	
Management body is active *(Members attend meetings regularly; body implements the management plan and enforces the provisions in the ordinance.)*	
Budget from local government or other sources allocated and is accessible for MPA management *(There is a legal document by the local government or an agreement with the private sector allocating budget for MPA management.)*	
Fishing effectively stopped inside the sanctuary zone *(No fishing-related violations/apprehensions reported in the sanctuary for the past six months.)*	
Illegal and destructive fishing reduced outside of MPA *(Violations/apprehensions reported outside sanctuary were reduced by 50% for the last six months.)*	

Level IV: MPA Sustained: Very Good (year 3 or after) (25 points)

Criteria or activity satisfied	**0/1**
MPA management plan updated and adopted in a participatory process *(Revisions made with the participation of all stakeholders: fishers, dive operators, partners, LGUs, resource users and social groups, both men and women)*	
Biophysical monitoring and feedback of results implemented for two years or more *(Documented surveys using standard/accepted method; reports are available.)*	
Monitoring includes local participation *(Locals were trained to do monitoring.)*	
Budget from government or other sources allocated and is accessible for two or more consecutive years *(There is a legal document by local government or an agreement with the donor, allocating budget for MPA management.)*	
Management body capacitated for financial management as needed *(Management body is able to handle its money effectively, i.e., facilitates wise use and proper documentation)*	
Enforcement system fully operational *(Enforcement group with clear mandate and workplan; enforcement system fully operational for at least one year)*	
Illegal and destructive activities stopped inside and within vicinity of MPA *(No violations/apprehensions reported in the past year.)*	
Environment-friendly enterprise and/or fees initiated as part of MPA *(Imposes collection of user's fees; sells environment-friendly souvenirs to tourists, etc.)*	

Level V: MPA Institutionalized: Excellent (year 4 or after) (30 points)

Criteria or activity satisfied	**0/1**
MPA management plan incorporated in LGU development plan	
Monitoring of impacts on environment and socioeconomics conducted and feedback of results completed *(Reports on biophysical assessment, attitude and perception surveys, and economic valuation studies conducted are available; results reported to stakeholders)*	

Table 1 (cont.)

Table 1 (cont.)

Information on MPA management plan, rules and monitoring maintained *(Information campaign has reached 60% of affected communities through brochures, posters and installation of signboards)*	
Revenues from enterprises and/or fees sustained and accounted for *(Collection of fees consistently enforced and recorded properly; financial report easily accessible)*	
Management plan reviewed and updated *(Further refinement of management plan after it has been revised)*	
MPA used as a study tour site; residents advocate for MPAs *(Presence of an identified group that conducts tours and is capable of giving relevant information about the MPA)*	
Expansion strategies considered or initiated *(There are plans of increasing the size of the MPA and/or enlarging the scope of activities in it, e.g., outreach programs, culturing of clams, etc.)*	

Total points accumulated:______

- Total possible points: 38
- All points are cumulative. Points from higher levels can be used to satisfy lower rating levels.
- Required points for the levels:
  - » I: Passing = 6 points accumulated
  - » II: Fair = 12 points accumulated
  - » III: Good = 20 points accumulated
  - » IV: Very Good = 25 points accumulated
  - » V: Excellent = 30 points accumulated

Date of survey: ________

Researcher/source of information: ____________________ Affiliation/institution: ________________________

Table 2. Summary of ratings of MPAs from the MPA database (CCEF and MPA Project collaborators 2003).

Rating Level	MPA Category	Management Performance	% of Records	Activities Usually Satisfied
1	Initiated	Passing	14	Education programs started Social acceptance sought Management body tentatively determined
2	Established	Fair	6	Ordinance declaring a sanctuary is approved High community acceptance Management activities started
3	Enforced	Good	9	Management body is active Fishing and illegal activities reduced Biophysical monitoring and measuring habitat changes conducted
4	Sustained	Very Good	6	Enforcement system fully operational Illegal and destructive activities stopped Environment-friendly enterprise or collection of user's fees initiated
5	Institutionalized	Excellent	1	MPA used as a study tour site with residents MPA management plan incorporated in the local government's development plan Revenues from enterprise and/or fees sustained and accounted for
No data	-	-	64	-

Table 3. Different management strategies of surveyed MPAs.

Type of Management	%
National government through NIPAS Act	10
LGU with assistance from national government and NGOs	11
People's organization with assistance from national government, LGU and NGOs	44
Private sector or dive resort owners	4
NGO	2
Multisectoral	1
No information	28

Table 4. Average size of 142 MPAs.

Area (ha)	Records No.	%	Average Area (ha)
Less than 6	21	15	3.44
6 - 50	79	56	15.01
51 - 2,000	20	14	603.94
2,001 – 300,000	22	15	81,052.35

have a common framework from which to evaluate their work and the relative success of MPAs.

The national government is assisting to implement large MPAs declared under the NIPAS Act. But, given scarce funding for operations and the tremendous needs of management, most of these sites have limited field operations and depend on implementation strategies that involve community and local stakeholder participation. In this regard, the MPA rating system is equally applicable to MPAs declared under NIPAS and the process is similar to those declared under the local government.

A common observation from most of the successful MPAs is that the local government together with people's organizations must play a key role in implementation. Assistance from national government agencies, academe and NGOs is also often crucial. The level of involvement of an organization varies among sites. However, the presence of a strong leader with unwavering resolve to enforce the law can make the difference between success and failure. Likewise, the presence of a multisectoral consultative group is very helpful.

In many MPAs, there is confusion in the process of implementing resource management interventions. This is due to the absence of clear guiding agenda to follow for management. A realistic and evolving management workplan is thus necessary to guide the implementing body in achieving their goals for sustainable management and habitat protection. The MPA management rating system will help. Funds for management are needed to cover the cost for boundary markers and anchor buoys, signs, guardhouse, patrol boat, flashlights and other equipment necessary for effective enforcement. Sources include budget allocations of local governments, grants from private sector or NGOs and collection of users' fees.

Future Directions

The MPA management rating system is assisting in better understanding of how MPAs work and what constitutes an effective and successful MPA. These findings are being used in creating MPA models that can serve as guides for newly created or managed MPAs and to improve quality and objectives of management. The MPA database system will help centralize and standardize monitoring of Philippine MPAs over time in all aspects of information that are relevant to track. Collaboration among government, academe, NGOs and other institutions is essential in this regard.

References

CCEF (Coastal Conservation and Education Foundation) and MPA (Marine Protected Area) Project collaborators. 2003. Marine protected coast, reef and management database 2003: Improving coral reef marine protected area management in the Philippines. CCEF, Cebu City, Philippines. (Unpublished).

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001. Philippine coastal management guidebook nos. 1-8. Coastal Resource Management Project of DENR, Cebu City, Philippines. Var. p.

Pajaro, M., F. Olano and B. San Juan. 1999. Documentation and review of marine protected areas in the Philippines, a preliminary report. Haribon Foundation for the Conservation of Natural Resources, International Development Research Centre-Canada and British Embassy, Philippines.

Roberts, C.M. and J.P Hawkins. 2000. Fully-protected marine reserves: A guide. Endangered Seas Campaign, World Wildlife Fund, Washington DC, US, and Environment Department, University of York, York, UK.

Salm, R.V., J.R. Clark and E. Siirila. 2000. Marine and coastal protected areas: A guide for planners and managers. Third ed. International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland.

White, A.T., C.A. Courtney and A. Salamanca. 2002. Experience with marine protected area planning and management in the Philippines. Coast. Manage. 30(1): 1-26.

Multiple Small-scale Marine Sanctuaries in Municipal Waters: The Magsaysay Example[1]

WILLIAM R. ADAN
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Philippines

Introduction

The establishment of a marine sanctuary is a valuable tool in coastal resource management (CRM). There is evidence that "no take" zones in coastal waters serve as breeding and nursery grounds of many marine species. Moreover, they bring back healthy populations of marine life with the restoration of degraded habitats within the reserves. A sanctuary thus can become a source of eggs, fry and new fish to replenish the productivity of adjacent waters.

The Fisheries Code of 1998 mandates municipal local governments to allocate, where applicable, at least 15% of their coastal waters as a sanctuary or no-fishing area. The choice between establishing one "big" sanctuary, covering thousands of hectares or many smaller "postage stamp" size sanctuaries in the municipal water remains a question for planners and scientists. The key factors that determine this choice include the availability, size and distribution of marine habitats, water quality and local oceanography, as well as willingness of the community to manage the area and abide by the sanctuary rules.

Site Profile

Magsaysay is located on the northeastern part of Misamis Oriental, 152 km from Cagayan de Oro, and 31 km from Gingoog City (Figure 1). The municipality has a 15-km coastline that is fringed by coral reefs and dotted with various species of mangroves. The coastal waters of Magsaysay, which have yet to be delineated, have an estimated area of 175 km^2. It has nine coastal barangays with a fishing population of 1,017 (MSU 2002).

The Magsaysay coastal waters are noted for sardine, flying fish and milkfish fry fishery. Blue crabs and various species of coral reef fishes abound in the area. Older fishers in the area claim, however, that these diverse and rich marine resources have declined severely since the early 1970s when illegal and destructive activities, particularly dynamite fishing, became rampant in the area.

"Postage Stamp" Sanctuary Establishment

The Technology Outreach and Community Help Foundation was the first nongovernment organization to introduce CRM in Magsaysay, Misamis Oriental. The foundation started organizing the fisherfolk of Sta. Cruz in 1994 to address issues of damaged coastal habitats and declining fish yields. Over six years, it helped assist the eight barangays of Magsaysay to establish marine sanctuaries as a strategy to restore the productivity of their coastal waters. A total of 87.6 ha of independent community-based marine sanctuaries were declared in Magsaysay, distributed as follows: Sta. Cruz (4.6 ha), Damayuhan (9 ha), Villa Felipe (9 ha), Poblacion (2 ha), Bonifacio (9 ha), Artadi (6 ha), San Isidro (21 ha), Kandiis (21 ha) and Consuelo (6 ha) (Figure 1).

Experiences

Resistance to sanctuary establishment. The establishment of a sanctuary, more often than not, has polarized the community. Opposition to the sanctuary was often caused by the perception that the fishers were deprived of their right to fish in their traditional fishing ground. In most cases, there was apparently a

[1] This paper can be cited as follows: ADAN, W.R. 2004. Multiple small-scale marine sanctuaries in municipal waters: The Magsaysay example, p. 232-236. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

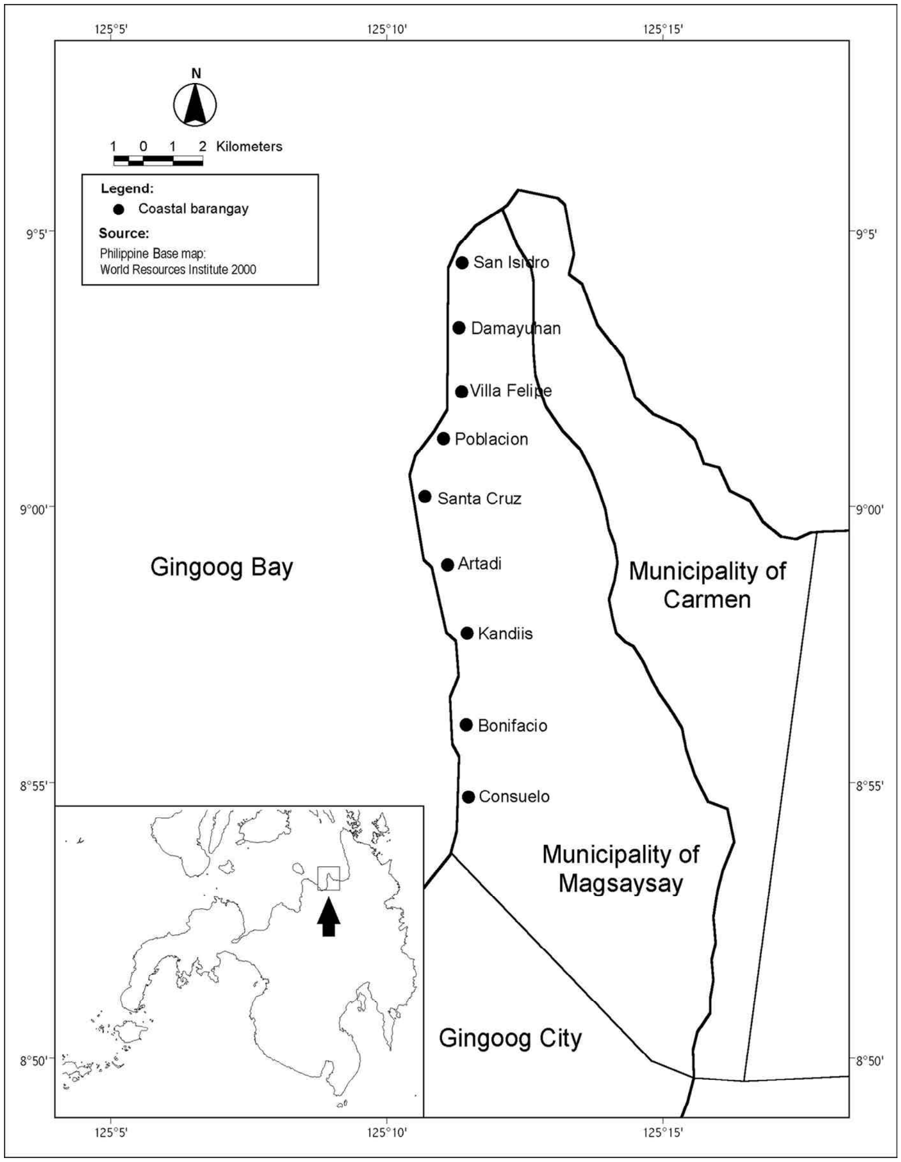


Figure 1. Location of Magsaysay municipality and its nine coastal barangays.

direct correlation between local poaching in the sanctuary and level of community support. In Villa Felipe and San Isidro where 40-50% of the residents were opposed to sanctuary establishment, poaching and destruction of sanctuary markers were generally attributed to local resident fishers. In barangays with higher level of community support (75-85%), poaching and other violations of sanctuary rules were usually committed by nonresident fishers.

Site and physical configuration of sanctuary. All the sanctuaries are located in sites with coral reefs and seagrass beds, with each being scientifically assessed prior to establishment. The sanctuaries are constructed adjacent and parallel to the coastline, extending seaward in either square or rectangular shape. Only the 21 ha sanctuaries of San Isidro and

Touch Foundation, Inc.

Figure 2. Signboard showing Kandiis MPA in Magsaysay.

Damayuhan (9 ha) have a buffer zone of 50 m x 50 m and 20 m x 20 m, respectively. The buffer zone is off-limits to any fishing activity but allows the passage of small fishing crafts. The rest of the sanctuaries have restricted use areas along their left and right sides. Hook-and-line fishing, gleaning and swimming are the only human activities allowed in these areas.

Management system. All sanctuaries are managed by the barangay local government, supported by the Barangay Fisheries and Aquatic Resources Management Council and the local peoples' organizations. The sanctuaries were established through the passage of a barangay ordinance that was approved by the Barangay Council (*Sangguniang Bayan*), following the standard procedure in local legislation prescribed by Republic Act 7160, the Local Government Code of 1991.

Guardhouse construction. Semi-permanent guardhouses or watchtowers were constructed in strategic locations in six of the eight established sanctuaries to safeguard the protected area. Their construction cost has been shared 50-50 by barangay and municipal funds. Most guardhouses have searchlights and guards are provided with handheld radios connecting them to barangay authorities. Volunteers, like *Bantay Dagat*, barangay-authorized guards and the Civilian Volunteer Organization (CVO), guard the sanctuaries.

Impacts

Biological and economic gains. Fishers claim that fish in the protected area have increased both in number and species diversity. This claim is supported by the Mindanao State University assessment in 2000-2001 (MSU 2002). Fishers also claim that their fish catch in adjacent waters has increased from the range of 0-5 kg/4 hours of fishing to 5 kg or more. Catches have increased over time in sanctuaries established earlier that adopted heavy guarding and strict implementation of rules and regulations, like Sta. Cruz, Poblacion and Bonifacio. From interviews, fishers in these areas disclosed that their daily income from fishing also increased from the range of P200 to as much as P600 in some days. In Sta. Cruz, the oldest established sanctuary (1996), the fisherfolk organization has purchased and installed a mini ice plant to preserve fish surplus intended for distribution to outside markets. The availability of crushed ice in the locality reduces spoilage and allows fishers to dispose of their catch in urban areas like Butuan City and Gingoog City, thus increasing their income.

Collateral benefits. Sanctuary establishment led to the generation of income augmentation projects intended primarily for displaced or adversely affected fishers, although later other members of the community were included as beneficiaries of the projects. These projects include seaweed farming; livestock dispersal (kabir, goat, swine and cattle); contour farming for pineapples and banana production; and multipurpose cooperative operation. The beneficiaries disclosed, however, that their incomes from these livelihood activities were less than from fishing. They blamed the unpredictable weather in the area for crop failures, and the high cost of feed for losses in animal production ventures.

Recommendations

While the Barangay Council takes the lead in management of the sanctuary, there is, however, no definite structure and authority within it that gives focus to the sanctuary alone. Most activities on the sanctuary are done on volunteer or *bayanihan* basis, a system that is often unreliable. It is therefore necessary that a Sanctuary Management Board be created under the immediate supervision of the Barangay Council. A sanctuary manager may be designated or appointed by the council and committees created in the board to address specific tasks or concerns such as maintenance, monitoring, evaluation, surveillance, enforcement and education. The members of the board and the different committees should come from the fisherfolk organization in the area.

The creation of buffer zones should be encouraged for small sanctuaries (4-9 ha). This would prohibit fishers from directly fishing on the boundary lines of the sanctuary, the effect of which is just like fishing within the sanctuary. During the Sanctuary Managers Forum held in Magsaysay in early 2003, some local government representatives responded to the issue by agreeing to amend their respective sanctuary ordinances for the creation of buffer zones (Table 1).

Milkfish or *bangus (Chanos chanos)* fry catchers have persistently requested to exclude their catching ground from the 21-ha marine sanctuary. This proposal should be carefully considered. On one hand, their livelihood could be protected by moving the shoreline boundary of the sanctuary seaward and establishing it immediately next to a properly demarcated *bangus* fry ground. On the other hand, fry gathering with the use of push nets with extremely small mesh sizes tends to impact larvae and juveniles of many other species, not just *bangus*. This lessens the contribution of marine protected areas (MPAs) as a nursery ground.

Table 1. Summary workshop output of the Magsaysay Marine Sanctuary Managers' Forum, February 2003, Poblacion, Magsaysay, Misamis Oriental.

Best Practice	Gain / Benefit	Problem	Need / Solution
Intensive public consultation on sanctuary establishment	Observable increase in fish stock and species diversity	No clear management structure and authority	Organize within the Barangay Council a Sanctuary Management Board
Proper site assessment	Regeneration of corals and increase in seagrass cover	No individual or group tasking of responsibilities and accountabilities	Create task committees with clearly defined roles, functions and responsibilities
Proper boundary demarcation	Increase in fish catch and income of fishers	*Bayanihan* basis on the maintenance of the sanctuary is irregular and unreliable	Develop sanctuary and resource management and operational plan
Legitimized by barangay and municipal ordinance	Livelihood projects resulting from sanctuary establishment	Resource and impact assessment purely perceptive and unsystematic	Conduct training on participatory resource assessment, monitoring and evaluation
	Increased ecological awareness among residents	Fishing done alongside sanctuary boundaries	Create buffer zones where fishing is restricted to protect the core sanctuary area
Construction of guard house(s) with communication facilities and searchlights	Other CRM activities, like mangrove reforestation and beach cleanup followed sanctuary establishment	Guarding of the sanctuary is irregular, on and off basis	Develop a system for continuous guarding through periodic assignment/ shifting/rotation of guards
Community participation in surveillance and protection	Coastal folk identify with the sanctuary and develop a sense of community pride	Lack of patrol boats and surveillance equipment	Allocate barangay funds to purchase patrol boat and surveillance equipment
Presence of volunteer organizations (CVO, *Bantay Dagat,* barangay guards) to guard the sanctuary	Well-maintained sanctuaries with guardhouses attract local visitors	Difficulty in filing cases against violators in court	Provide paralegal training to deputized fish wardens, CVO, *Bantay Dagat* and barangay guards; municipal government to allocate funds for court cases
		Poaching and lost boundary markers	Provide continuing education and information drive and community participation in surveillance and protection; develop and install strong, all-weather markers

Conclusion

"Postage stamp" sanctuaries may have the advantage over a single larger sanctuary in municipal waters as these mobilize more ecologically and politically conscious people covering a wider area compared to a single sanctuary. Since more people have developed a strong attachment to and sense of ownership of their sanctuary and immediate waters, there is a higher probability of sustaining appropriate management of coastal resources.

The establishment of a marine sanctuary is the most visible starting point for other coastal management interventions. While at the start it may polarize a community, it may later become the rallying point for other coastal management efforts once its tangible benefits are made manifest to the people. Networking the marine protected areas in a given body of water consolidates management efforts and concerns and may expand the restorative and enhancing effects of MPAs to coastal habitats and resources.

The experience of Magsaysay shows that collective effort and self-discipline are possible only when the members of the community understand the issues and concerns that affect them and work together towards a common goal. It is evident that sacrifice and deferred gratification are values that a community can learn. When these values are internalized, the coastal folk may avoid what Hardin (1968) called the "tragedy of the commons".

References

Hardin, G. 1968. The tragedy of the commons. Science 162: 1243-1248.

MSU (Mindanao State University). 2002. Resource and social assessment of Gingoog Bay. Fisheries Resource Management Project Terminal Report. MSU Naawan Foundation for Science and Technology Development, Inc., Misamis Oriental, Philippines.

Artificial Reefs and Fish Aggregating Devices: Help or Hindrance?[1]

RICARDO P. BABARAN
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo, 5023
Philippines

Introduction

Demersal fish species have been observed to associate with submarine features like seamounts or banks, while pelagic ones usually aggregate near floating or drifting objects or structures. This information has been used in the deployment of artificial structures either at the sea bottom, called artificial reefs (ARs), or anchored or drifting at the surface or midwater levels, commonly called fish aggregating devices (FADs), to attract and aggregate fish to support certain fisheries.

A number of hypotheses have been forwarded to explain the mechanisms responsible for the attraction and/or aggregation of fish near ARs or FADs. These separately deal with the natural tendency of fish to aggregate near areas with abundant food supply; behavior of fish to seek refuge from predators; utilization of structures as reference points to guide the movement of fish; and tendency of fish to use structures as social aggregation points (Pickering and Withmarsh 1997; Freon and Dagorn 2000).

FADs and ARs have been deployed in the Philippines since the 1970s. It has been assumed that they enhance fisheries but as evidence suggests otherwise, they have become rather controversial for various reasons. Key issues related to these structures in the Philippines include the following (White *et al.* 1990; Munro and Balgos 1995):

- They have proliferated around the country with little or no regulation and management.
- They have been encouraged and placed as "fisheries enhancement" tools without proper monitoring and evaluation.
- ARs are commonly believed to function like coral reef ecosystems, but in reality they have been shown only to aggregate marine organisms. There is little evidence to suggest productivity is enhanced through their use, but strong evidence that they contribute to overfishing.
- FADs have very limited productivity potential, especially for juvenile fishes, making their catch much easier without management and regulation.

Artificial Reefs

ARs have been used to enhance coastal fisheries in Japan and in other countries for several hundred years (Buckley 1985). They provide shelter for adult and juvenile fish (Bohnsack 1989), reference points for orientation (e.g., for formation of schools), feeding areas (Bohnsack 1989) and breeding areas (White *et al.* 1990).

In the Philippines, ARs have been traditionally used in the Visayas as early as the 1950s using small collections of branches, twigs and other materials called *gango*, usually used for aggregating certain demersal species such as rabbitfish and snapper. These were harvested every few months or daily through the use of fishtraps placed within the area and each *gango* had an owner who had exclusive use over the FAD.

Following the trend in Malaysia and Thailand in the 1970s, the Philippine government embarked on an artificial reef development program in the 1980s and early 1990s. The reefs were mostly constructed with low-profile bamboo materials or used tires (Figure 1) (Miclat 1988). Over 25,000 units of these reef modules were deployed in 75 sites throughout the country

[1] This paper can be cited as follows: BABARAN, R.P. 2004. Artificial reefs and fish aggregating devices: Help or hindrance?, p. 237-240. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

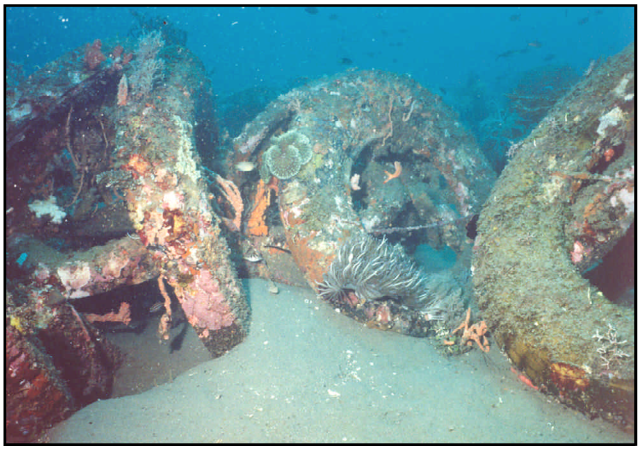


Figure 1. Tires used for artificial reefs.

(Miclat 1988; Delmendo 1991). Although concrete is usually preferred because it can be molded easily and lasts longer in seawater, there were only limited attempts to use it due to higher cost. With increasing awareness over the destructive impacts of bottom trawls in the 1980s, ARs were also used as deterrent to trawling in coastal waters. The use of certain materials such as tire and junk vehicles was later discouraged as they were found to contain pollutants that leech into seawater.

The species aggregating near tire and bamboo ARs were mostly benthic organisms because of their position and deployment in shallow reef areas. Reef species quickly colonize shallower ARs which began to resemble a miniature reef after about 10 years. But the question of increased productivity versus simple aggregation has been the subject of several studies.

After the Fisheries Sector Program promoted ARs in 1990-1994, their use as a management tool waned. There are now many documented examples of poor deployment of ARs, even placing them directly over reefs, destroying these in the process. One study conducted by the Resource Management Division of Negros Oriental indicated the strong aggregating capacity of ARs and concluded that even if they cover only a small percentage of the existing natural coral reef area, they can severely contribute to overfishing (Waltemath and Schirm 1995). Generally, there would be no lack of fish habitat in an overfished ecosystem, such as in the Philippines. Yields from artificial reef sites are estimated to be about 150 times higher than those from natural coral reefs (Waltemath and Schirm 1995). This shows that unregulated fishing in ARs may do much more harm than good to reef fisheries.

Based on these lessons, the Philippine national government, through the joint Department of Environment and Natural Resources - Department of Agriculture – Department of the Interior and Local Government – Department of National Defense (DENR-DA-DILG-DND) Administrative Order No. 97-01, series of 1997, banned the further use of ARs and FADs in the country, without specified management guidelines. This was superceded in 2000 by the Joint DENR-DA-DILG-DND Memorandum Order No. 2000-01 which laid out guidelines on the establishment, management and utilization of ARs in municipal waters and encouraged their use under strict criteria. It is stipulated that ARs are only allowed in no fishing sanctuaries.

Fish Aggregating Devices

The use of FADs as a fishing gear accesory has also proliferated around the country since 1980. Being fairly cheap to assemble with local designs costing no more than $100 (P5,400), they are widely used. In fact, their abundance and use are now having serious repercussions for fisheries management in the Philippines. Their placement inside municipal waters has also encouraged illegal entry of commercial fishing vessels tempted by large catches as FAD owners get at least 25-35% increase in value of the total catch around their FADs. For instance in the province of Bohol, it is estimated that there are more than 1,000 FADs within its coastal waters, with the majority being owned by commercial and nonfishers. Over 90% of FADs are within 10 km of the coastline of the province and are regularly used by commercial fishers (Green *et al.* 2002).

Anchored FADs, locally called *payaw*, essentially have four main parts: a floating structure, an aggregating device, an anchor and a rope line. The floating structure is typically a raft made of bamboo (Figure 2). Bamboo, however, has a limited lifespan especially when rammed by ships. Thus, to prevent loss of the FAD, a steel tank is sometimes used in place of a bamboo raft. In other FAD designs, the floating structure is formed with the use of several pieces of vertically oriented bamboos that are bundled together (Malig *et al.* 1991).

The aggregating device is formed by hanging a line holding several coconut or palm fronds and its depth sometimes extends down to 35 m below the sea surface. The anchor, which is made of concrete and molded using a 200-l fuel drum, serves to hold the floating structure in place. The line that links the floating structure to the anchor is a polypropylene rope with a diameter of 14-16 mm depending on the speed of the water current in the fishing ground. Because it has a lower specific gravity relative to seawater, the polypropylene rope tends to float in seawater.

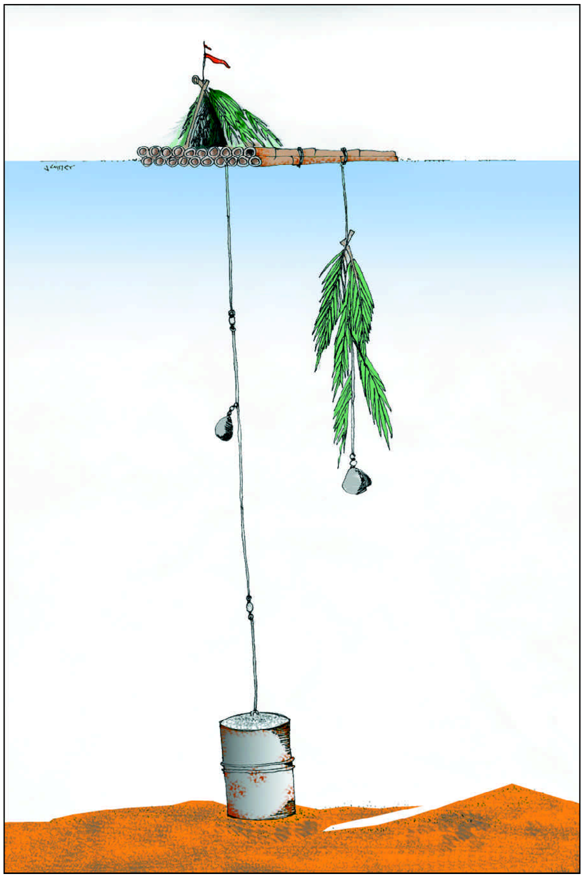


Figure 2. *Payaw.*

Similar to ARs, anchored FADs are normally deployed to support or sustain fishing operations of fishing gears mostly for those of commercial operators, such as purse seine and ring net. The operation of these gears near anchored FADs may be partially responsible for the tremendous increase in the country's fisheries production of tuna species (especially juveniles) since the 1970s (Figure 3).

Aside from ringnet and purse seine, several types of line gears are used by artisanal fishers near anchored FADs. The line gears used include single and multiple hook-and-line, troll and, to a limited extent, single set lines and longline. Although prohibited by FAD owners, surface set gillnet operations that involve the dispersal of minced fish meat laden with toxins from plants are done.

The types of fish captured by different fishing gears operating near anchored FADs depend on the water levels where gears are cast. Gears that are usually deployed over a fishing zone near sea surface like purse seine, ringnet, line gears with small-sized hooks and the prohibited set gillnet capture similar species. These are mostly juveniles of yellowfin tuna (*Thunnus albacares*), juveniles and, sometimes, adult sizes of skipjack tuna (*Katsuwonus pelamis*), and several small pelagic species of jackfish, including *Selar crumenopthalmus* and *Decapterus macrosoma*.

Meanwhile, handline fishers using a drop-stone fishing technique usually capture adult sizes of yellowfin tuna and sometimes bigeye tuna at water depths ranging from 40 m to 200 m. Troll fishers, meanwhile, capture dolphinfish (*Coryphaena hippurus*) and billfish (*Istioporidae)* from relatively shallower depths or near the surface, usually with the use of lured hooks but sometimes simply with fibrous lures.

FADs have also more recently been implicated as the main cause in several serious shipping accidents. A lack of regulation and management in their use is allowing proliferation in shipping lanes and navigation routes around the country. Similar to ARs, evidence

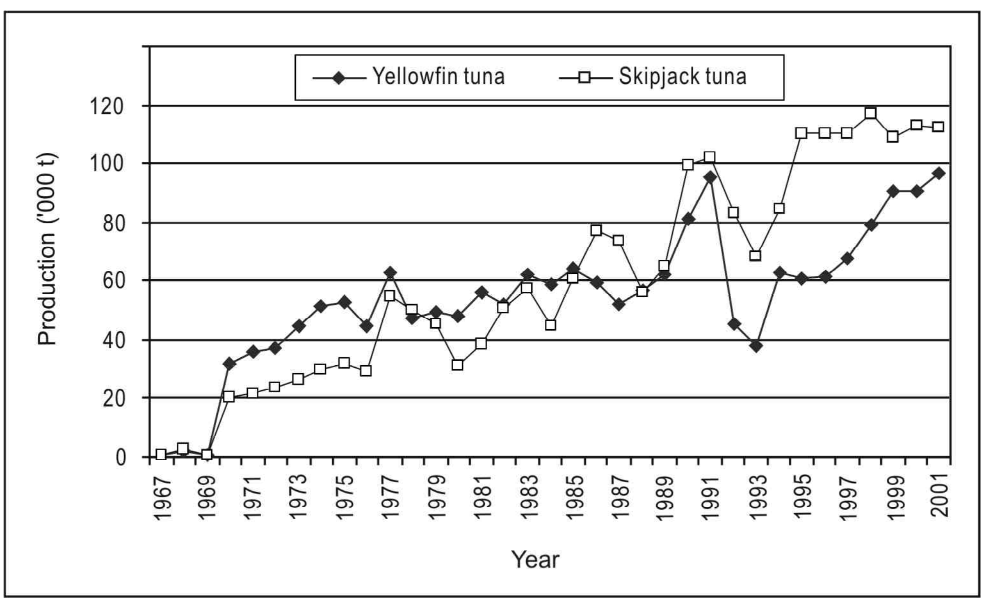


Figure 3. Philippine production trends for yellowfin and skipjack tuna, 1967-2001 (FAO Fishstat).

suggests that FADs do not increase fisheries production, despite fishers believing them to be spawning areas of key species. Like ARs, they merely aggregate fishes, both mature and juvenile, and facilitate their capture, thus aggravating overfishing (Pickering and Whitmarsh 1997). They also increase conflicts between commercial and municipal fishing sectors on who gets access to scarce fish resources.

Conclusion

FADs and ARs require further research and scientific studies. Based on existing studies, they have on the whole had a negative impact on fisheries in the country and have contributed to overfishing. Steps should be initiated to at least limit or regulate the combined number of FADs developed by commercial fishers and those owned by nonfishers. Further use of FADs and ARs should only be pursued within the framework of comprehensive coastal and fisheries management plans, which are implemented and monitored.

References

Bohnsack. 1989. Are high densities of fishes at artificial reefs the results of habitat limitations or behavior preference? Bull. Mar. Sci. 44(2): 631-645.

Buckley, R.M. 1985. Habitat enhancement and urban recreational fishing, p. 365-382. *In* F.M. Ditri (ed.) Artificial reefs: marine and freshwater applications. Lewis Publishers, Inc. Michigan, USA.

Delmendo, M.N. 1991. A review of artificial reefs development and use of fish aggregating devices (FADs) in the ASEAN region, p. 116-141. In V.L.C. Pietersz (ed.) Symposium on Artificial Reefs and Fish Aggregating Devices for the Management and Enhancement of Marine Fishery Resources, 14-17 May 1990, Colombo, Sri Lanka. Regional Office for Asia and the Pacific, Food and Agriculture Organization, Bangkok, Thailand. 435 p.

FAO (Food and Agriculture Organization). Fishstat Plus, version 2.3. FAO Fisheries Department, Rome, Italy.

Freon, P. and L. Dagorn. 2000. Review of the fish associative behavior: Towards a generalization of the meeting point hypothesis. Rev. Fish Biol. Fish. 10: 183-207.

Green, S.J., R.D. Alexander, A.M. Gulayan, C.C. Migrino III, J. Jarantilla-Paler and C.A. Courtney. 2002. Bohol Island: Its coastal environmental profile. Bohol Environment Management Office, Bohol, and Coastal Resource Management Project, Cebu City, Philippines. 174 p.

Malig, J.A., S. De Jesus and J.O. Dickson. 1991. Deep-sea fish aggregating devices (FADs) in the Philippines, p. 214-228. *In* V.L.C. Pietersz (ed.) Symposium on Artificial Reefs and Fish Aggregating Devices for the Management and Enhancement of Marine Fishery Resources, 14-17 May 1990, Colombo, Sri Lanka. Regional Office for Asia and the Pacific, Food and Agriculture Organization, Bangkok, Thailand. 435 p.

Miclat, R.I. 1988. Artificial reef development: The Philippine experience. Report of the Workshop on Artificial Reefs Development and Management. ASEAN/SF/88/GEN/8.

Munro, J.L. and M.C. Balgos, Editors. 1995. Artificial reefs in the Philippines. ICLARM Conf. Proc. 49, 56 p.

Pickering, H. and D. Whitmarsh. 1997. Artificial reefs and fisheries exploitation: A review of the “attraction versus production” debate, the influence of design and its significance to policy. Fish. Res. 31: 39-59.

Waltemath, M. and B. Schirm. 1995. Effects and management of artificial reefs, including experiences outside the Philippines, p. 25-30. In J.L. Munro and M.C. Balgos (eds.) Artificial reefs in the Philippines. ICLARM Conf. Proc. 49, 56 p.

White, A.T., L.M. Chou, M.W.R.N. De Silva and F.Y. Guarin. 1990. Artificial reefs for marine habitat enhancement in Southeast Asia. ICLARM Education Series 11, 45 p. International Center for Living Aquatic Resources Management, Philippines.

Invertebrate Stock Enhancement[1]

MARIE ANTONETTE JUNIO-MEÑEZ
Philippine Environmental Governance Project
3/F M&L Bldg., 29 Road 1
Project 6, Quezon City
and
Marine Science Institute
University of the Philippines
Diliman, Quezon City
Philippines

Introduction

The Philippines has a high diversity of commercially important invertebrate fishery resources belonging to three major groups: crustaceans (i.e., shrimps, crabs, lobsters); molluscs (i.e., gastropods, bivalves, cephalopods); and echinoderms (i.e., sea cucumbers and sea urchins). Various species of molluscs and echinoderms are a regular source of protein for poor coastal dwellers and a source of income for gleaners (Figure 1). Some of these are high-value food and shell species in both local and export markets (e.g., abalone, top shells, giant clams, window pane oysters, sea cucumbers and sea urchins). Because most of these species are found in shallow waters and are sedentary or slow-moving, their populations are highly vulnerable to overharvesting. Traditionally, commercial collectors and buyers move on to other sites once local populations are exhausted, resulting in their widespread depletion. One of the few documented cases is the case of giant clams, where a nationwide field survey in the mid-1980s found that three giant clam species - *Tridacna gigas, T. derasa* and *Hippopus porcellanus* - have been overfished (Juinio *et al* 1989). The last species, which has a very limited distribution in Southern Philippines, is virtually extinct.

Another is the case of the sea urchin fishery in Bolinao, Pangasinan, where overexploitation resulted in the collapse of this multimillion fishery (Talaue-McManus and Kesner 1995). Prior to its collapse, the sea urchin fishery was the major source of livelihood for many local coastal families and the single most valuable commercial fishery in the area (Figures 2 and 3). Anecdotal reports of fishers and traders indicate the same has happened in other places. Moreover, the same is true for sea cucumbers, top shells and abalone leading to a significant decline in total national production and exports. Despite these occurrences, very little attention has been given to the management of coastal invertebrate fisheries.


S. Green

Figure 1. Gleaners collecting sea urchins.

Stock Enhancement as a Management Strategy

Large-scale stock enhancement has been practiced in Japan for nearly a century. It is also used as a strategy to increase and sustain production of various invertebrate and finfish resources in other developed countries, such as Taiwan, Norway and USA. Stock enhancement commonly involves broodstock development, breeding, large-scale larval and juvenile rearing, release of seedstock to the wild and monitoring to assess possible impacts. As such, this technology and capital-intensive strategy is often a

[1] This paper can be cited as follows: JUINIO-MEÑEZ, M.A. 2004. Invertebrate stock enhancement, p. 241-245. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

last resort in fishery management, especially for poorer countries. However, due to widespread depletion of local invertebrate fishery resources and local extinction of species in the case of giant clams, smaller scale stock enhancement, in conjunction with the establishment of marine protected areas and habitat rehabilitation, has emerged as a viable option to enhance the recovery of some depleted populations.

Local stock enhancement initiatives include transplanting adults and/or juveniles from the wild population to a protected area, or release of hatchery-produced juveniles or subadults. In either case, resource managers attempt to enhance stocks of existing invertebrate species or to reintroduce a species that once thrived in an area. This contrasts with the common practice in the 1970s of transplanting adults or spat of the slipper oyster (*Crassostrea iredalei*) and the green mussel (*Perna viridis*) where the species did not naturally occur, for farming purposes.

Compared to transplantation of wild populations, the most significant efforts to date involve release of hatchery-produced juveniles to reestablish viable spawning populations. The longest running effort along this line is the reseeding of giant clams. In the 1980s, scientists from the University of the Philippines-Marine Science Institute (UPMSI) and Silliman University and from Australia and several Pacific Island nations collaborated on a research program to develop giant clam mariculture technology. In the 1990s, local conservation measures to reestablish viable clam populations started and continue to the present. Aside from hatcheries at the two research institutes, the Guiuan Development Foundation, Inc. also produces cultured giant clams. All seven local species of giant clams have been cultured at the Bolinao Marine Laboratory of UPMSI. In 1995, UPMSI started producing hatchery-reared juvenile *Tridacna gigas*, which is one of the endangered giant clam species. The species has been reseeded into 24 out of 27 restocking sites nationwide (Figure 4) (Mingoa-Licuanan and Gomez 2002). Stewardship arrangements with local government units (LGUs), people's organizations, private groups and nongovernment organizations have been solicited in this effort.

After the collapse of the sea urchin fishery in Bolinao in the early 1990s, UPMSI researchers pioneered the hatchery and growout culture of sea urchin *Tripneustes gratilla*. A strategy involving research, field monitoring, maintenance of broodstock in sea cages, reseeding and community-based growout was piloted in northwestern Luzon (Juinio-Meñez *et al.* 1998). Growout culture was done in collaboration with fishers' organizations, LGUs, regional state universities and BFAR to reestablish viable spawning populations and provide a supplemental source of livelihood to fishers. Growout culture in sea cages, while more labor-intensive, ensured high survivorship (63-87%) up to sexual maturity prior to harvesting, relative to reseeding (1-10%). Thus, growout culture was necessary to maximize survivorship of the limited seedstock produced (40,000–120,000 per year in 1996-2001) in the pilot hatchery. In 1999, the presence of natural recruits (i.e., early benthic juveniles) provided the first indication of stock recovery in Bolinao. To date, a small-scale fishery exists in Bolinao (Juinio-Meñez 2002). Unfortunately, lack of regulation may forestall further recovery of the sea urchin stocks.

The UPMSI hatchery in Bolinao has recently pioneered the production of sea cucumbers in collaboration with scientists from UP Mindanao and UP Visayas. In addition, top shells and abalone seedstocks have also been produced in 2002. As the new culture technologies are refined and scaled-up, a community-managed multispecies reef invertebrate sea farm, which will also serve as a reproductive reserve, will be piloted.

In the Visayas, the Aquaculture Department (AQD) of the Southeast Asian Fisheries Development Center (SEAFDEC) has stocked immature adult window pane oysters (*kapis*) along the Tigbauan coastline to reestablish spawning populations. Early harvesting by dredgers frustrated first attempts at enhancement. Subsequent efforts were done in close collaboration with LGUs to regulate harvesting and prevent depletion of spawning stocks.

Culture and stock enhancement of abalone and top shells are also underway at SEAFDEC (Platon and Yap 2002). The development of artificial feeds that can be used to tag abalone will be valuable in monitoring the viability of released hatchery-reared individuals. Notably, a Japanese company that exports local top shells to Japan is the only private restocking initiative. Alarmed at the reduced market supply of top shells, the company decided to establish a private hatchery in Palawan, which started producing juvenile topshells (*Trochus niloticus*) in 2000 to stock depleted areas in collaboration with SEAFDEC (Anon. 2001).

Ecological and Economic Considerations

The development of culture technologies for some of the local commercially important invertebrate species provides opportunities to expand options for mariculture in the country and contribute in the recovery of depleted wild populations. However, there are fundamental ecological considerations attendant to stock enhancement (e.g., Smith 1999). Hatchery-produced seedstocks are products of spawning of a

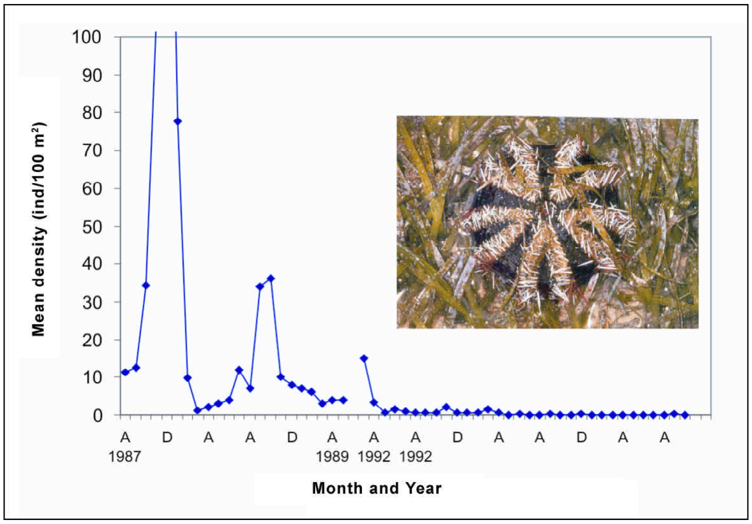


Figure 2. Overexploitation led to the collapse of the sea urchin fishery in Bolinao, Pangasinan, resulting in multimillion peso losses in terms of livelihood, supplemental food and exports.

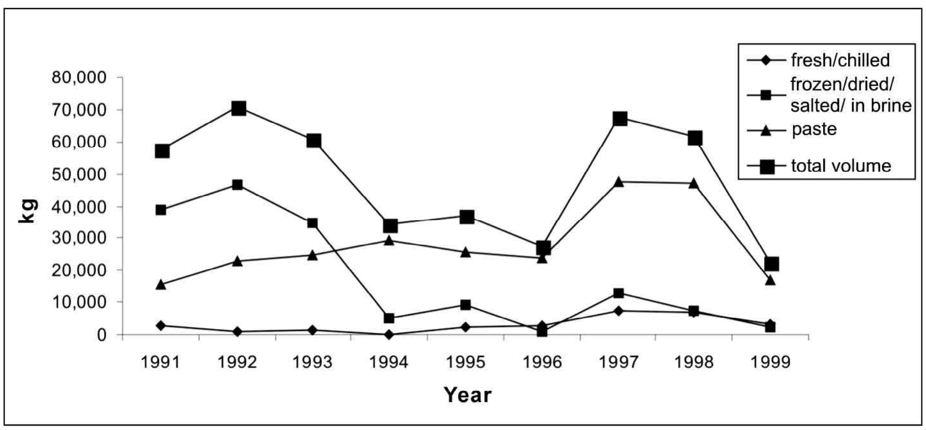


Figure 3. Philippine sea urchin roe exports have declined in recent years and have become increasingly dominated by lower value products (e.g., paste).

few individuals, thus loss of genetic diversity is a potential negative impact of releasing hatchery-produced juveniles. Similarly, relocation of broodstock or seedstock to another region with a distinct population genetic structure poses a threat to genetic diversity. This may reduce the populations' resilience to environmental changes especially if the fitness of hatchery-reared stock is inferior relative to natural stocks. Aside from this, unregulated stock enhancement can lead to displacement of other species in the natural environment, and transmission of hatchery-based diseases and parasites to wild stocks.

Aside from ecological considerations, economic ones constrain widespread utilization of stock enhancement as a resource management strategy. Fundamental to this are technical personnel and investment in hatchery production, which entail considerable capital outlay even for smaller scale seedstock production. Furthermore, proper monitoring of growth, survival and genetic structure of released hatchery stocks will require technical expertise that is presently limited in the country. In fact, the impact of many large-scale reseeding programs in developing countries is inconclusive and many doubt their economic viability.

Conclusion

In the interim, limited local stock enhancement efforts could be subsidized by national and regional research institutions to enhance the recovery of depleted natural stocks. The economic costs and potential long-term ecological costs of improper stock enhancement are quite high. Local efforts are unlikely to be viable without public-private sector partnerships. For this to work, appropriate disincentive (e.g., user

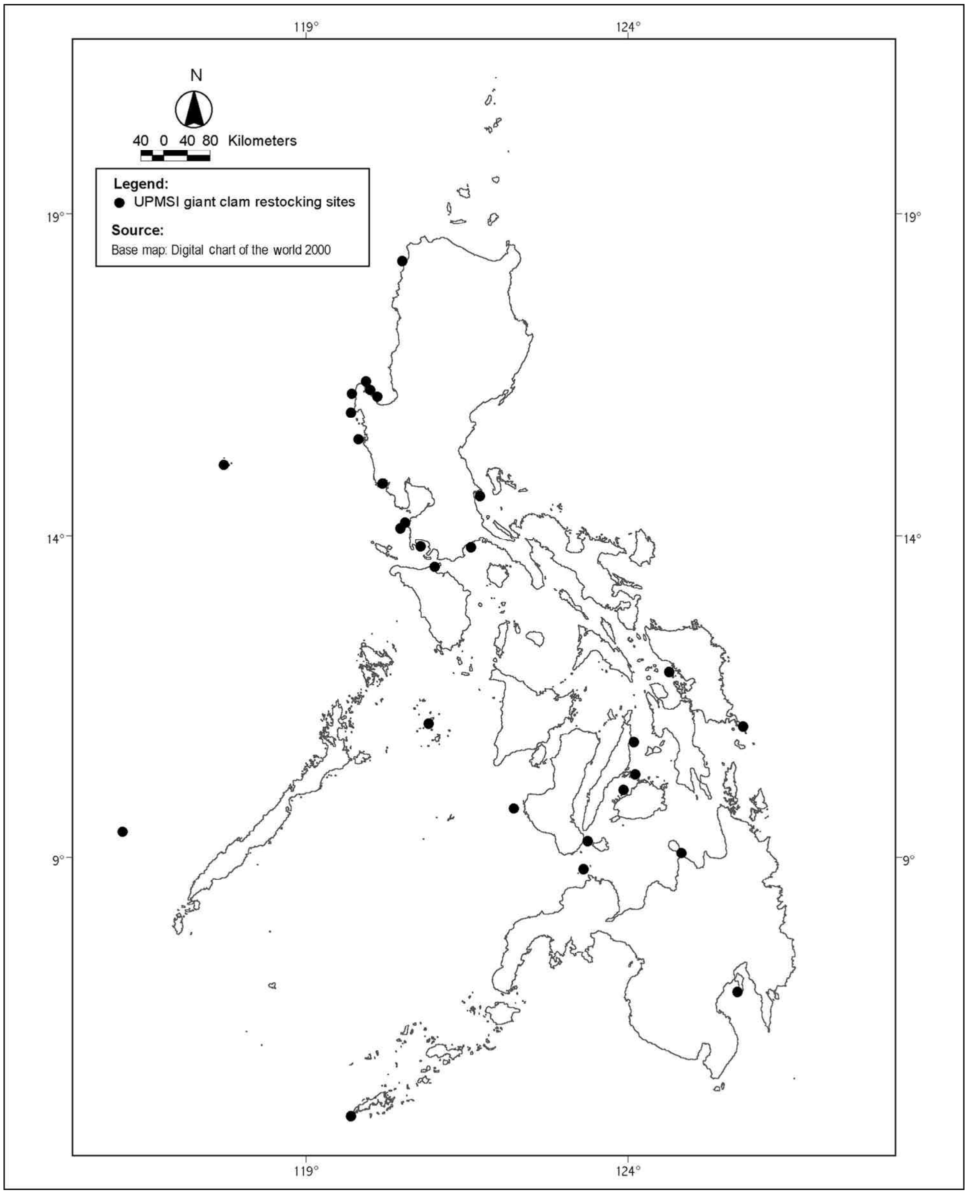


Figure 4. UPMSI's sites for giant clam restocking.

fees) and incentive systems (e.g., exclusive use rights) should be instituted and legitimized to promote responsible harvesting practices. The bottom line is the lack of sound resources management and good governance which precipitate into extreme conditions that make stock enhancement, along with other restoration technologies, an imperative. The only rational recourse is to prevent similar conditions from happening in the first place. The benefits of effectively managing natural populations can never be outweighed by any technological intervention.

References

Anon. 2001. Aquafarm news special feature: Stock enhancement. SEAFDEC Asian Aquacult. 23(5-6): 17-40.

Juinio-Meñez, M.A. 2002. Enhancement of *Tripneustes gratilla* populations in Pangasinan, northwestern Philippines. Paper presented at the Second International Symposium on Stock Enhancement and Sea Ranching, 28 January-1 February 2002, Kobe, Japan.

Juinio-Meñez, M.A., N.N.D. Macawaris and H.G. Bangi. 1998. Community-based sea urchin (*Tripneustes gratilla*) grow-out culture as a resource management tool. *In* G.S. Jamieson and A. Campbell (eds.) Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Can. Spec. Publ. Fish. Aquat. Sci. 125: 393-399.

Juinio, M.A.R., L.A.B. Meñez, C.L. Villanoy and E.D. Gomez. 1989. Status of giant clam resources in the Philippines. J. Molluscan Stud. 55: 431-440.

Mingoa-Licuanan, S.S. and E.D. Gomez. 2002. Giant clam conservation in Southeast Asia. Trop. Coasts 9(2): 24-31, 56.

Platon, R.R. and W.G. Yap. 2002. Prospects and challenges of stock enhancement and sea ranching in Southeast Asia. Paper presented at the Second International Symposium on Stock Enhancement and Sea Ranching, 28 January-1 February 2002, Kobe, Japan.

Smith, P.J. 1999. Genetic resources and fisheries: Policy aspects, p. 43-62. *In* R.S.V. Pullin, D.M. Bartley and J. Kooiman (eds.) Towards policies for conservation and sustainable use of aquatic genetic resources. ICLARM Conf. Proc. 59, 277 p.

Talaue-McManus, L. and K.P. Kesner. 1995. Valuation of a Philippine municipal sea urchin fishery and implications of its collapse, p. 229-239. *In* M.A. Juinio-Meñez and G. Newkirk (eds.) Philippine coastal resources under stress: Selected papers from the Fourth Annual Common Property Conference, Coastal Resources Research Network, Dalhousie University, Halifax, NS, Canada, and Marine Science Institute, University of the Philippines, Quezon City, Philippines.

The Potential Role of Restocking and Stock Enhancement in the Management of Marine Invertebrate Fisheries in the Philippines[1, 2]

JOHANN BELL
LEN GARCES
The WorldFish Center
P.O. Box 500 GPO, 10670 Penang
Malaysia

Introduction

Throughout Southeast Asia, capture fisheries are no longer yielding their potential harvests – in many cases, the abundance of valuable species has been reduced to 10% of previous levels (Silvestre *et al.*, in press). The result is that coastal fisheries are not supporting as many livelihoods as they could. This problem has been caused by overfishing, harvesting methods that damage the habitats supporting fish and invertebrates, and a general deterioration of inshore ecosystems (Silvestre and Pauly 1997; Talaue-McManus 2000). Overfishing is particularly severe in the case of many invertebrates, which are easy to collect due to their shallow distribution and sedentary habits. The coastal fisheries of the Philippines are suffering the same problems as those elsewhere in the region: catches have declined dramatically, and several of the most valuable species are now rare (Pauly *et al.* 1989; Barut *et al.* 1997).

The solution to overfishing is easy to identify, but difficult to implement. Basically, arrangements need to be made for fewer people to fish so that stocks can recover to levels that will enable them to provide greater yields (Hall 1999). This will involve hardship for the displaced fishers in the short to medium-term, and so they should be given some form of property rights as an incentive to make the sacrifices needed to restore stocks to more productive levels (i.e., they need to be the beneficiaries of the restored stock).

This remedial action is not easy for governments to implement because it involves loss of jobs for a period. The development of aquaculture promises to ease some of the pain of having to ask people to leave capture fisheries by providing alternative livelihoods in a fisheries-related sector. However, the development of aquaculture will not absorb all the effort that needs to be removed from fisheries to restore them to more productive levels.

The decisions facing many fisheries managers now center around questions like: how many people need to stop fishing?; how much of the fished area should be closed to allow recovery?; how long should these areas remain closed?; or perhaps even how long does the fishery need to be closed completely to allow recovery? Understandably, managers are under pressure to minimize the time needed to restore fisheries so that jobs can be made available as soon as possible. However, even with the application of stringent measures like a total moratorium on fishing, the time needed for recovery cannot always be predicted well due to great annual variation in the natural supply of larvae. Even under the best scenario, it may take several years before the remnant stock produces a year-class strong enough to replenish the stock (Doherty 1999). In some situations, multiple generation times may be needed for replenishment to the required level.

The desire to restore overfished stocks in the shortest possible time has led some managers to consider the use of restocking programs, where cultured juveniles are released to augment the remnant wild stock, thereby reducing the time needed to re-create a relatively large spawning biomass. The potential benefit of a restocking program must, however, be balanced

[1] This paper can be cited as follows: BELL, J. and L. GARCES. 2004. The potential role of restocking and stock enhancement in the management of marine invertebrate fisheries in the Philippines, p. 246-251. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.
[2] WorldFish Contribution No. 1694.

against the costs involved in producing large numbers of juveniles in hatcheries fit for survival in the wild, and there must be confidence that the intervention will make a significant and cost-effective reduction in the time required for recovery of spawning biomass. To make such decisions, managers need several pieces of information about the biology of the target species. This information is presented below[3].

Information Needed to Assess the Potential Benefits of Restocking

Stock delineation

A thorough understanding of the size and distribution of the stock(s) supporting a fishery is an important information needed to assess the need for restocking to design a responsible restocking program. In particular, managers need to know whether the fishery is based on a single homogeneous stock, or composed of multiple, largely self-recruiting population. A good indication of stock structure can be provided by a thorough analysis of the genetic population structure of the species, although some stocks can still be divided into relatively isolated units even when gene frequencies are generally homogeneous. Thus, other tools may also be needed to help determine stock delineation, e.g., multivariate comparison of morphometrics or species composition of parasites. Stock delineation equips managers to understand whether spawning biomass needs to be rebuilt for all, or just certain components, of the stock.

Stock assessments

Once the stock structure of the fishery has been identified, the status (stock size and age / size structure) of the population(s) should be identified. Only then can managers assess whether the spawning biomass of the population(s) is so low that it is unlikely to recover quickly enough simply by implementing conventional management measures, e.g., a total moratorium on fishing, or whether restocking will also be required to restore the number of spawning animals to levels that will once again allow regular substantial harvests to be made. Restocking is normally an expensive option, so restoration of spawning biomass should be based on other forms of management whenever possible, provided they will be effective within acceptable timeframes.

This process involves estimating how long it will take the spawning biomass of each population to recover with and without restocking (Heppell and Crowder 1998). To do this, the desired level of spawning biomass needs to be identified (e.g., 50% of the virgin level), and the data need to be collected that will enable the potential contribution of restocking to be assessed. These data include: remnant stock size, generation time, fecundity, annual variability in the settlement success of postlarvae, natural mortality at different life history stages, and behavior of the species that may affect spawning success or survival at low population density. Different restocking scenarios, e.g., variations in the frequency, number and survival rate of released animals, and the subsequent survival of their F1, F2, F3 progeny, should also be examined.

Capacity of hatcheries to produce sufficient juveniles

If the modeling described above indicates that restocking will be beneficial, an assessment then needs to be made to determine whether the existing hatcheries have the capacity to produce the required number of juveniles. Where the capacity of hatcheries is limited and it is not possible to invest in additional facilities, it may be necessary to produce juveniles over a longer period. This will mean that the restocking model developed above will need to be adjusted.

Other Components of a Responsible Restocking Program

If the decision is made to proceed with a restocking program, careful attention will also need to be paid to: (1) how juveniles are produced and released; (2) managing the restocked population(s); and (3) determining relative contributions of restocking to restoration of spawning biomass (Blankenship and Leber 1995; Munro and Bell 1997). A summary of the actions needed to complete these components of a responsible restocking program is set out below.

Hatchery protocols to maintain the genetic diversity of the stock. The hatchery practices needed to reduce the likelihood that the natural gene frequencies could be changed as a result of relatively large releases of cultured juveniles are described by Munro and Bell (1997) and references therein. These protocols include using large numbers of broodstock, replacing spawning animals regularly, ensuring that

[3] The following section is taken largely from Bell (in press) and Bell and Jamu (in press).

most broodstock spawn and preventing selective breeding among broodstock. If there are problems achieving any of these requirements, they can usually be solved by releasing multiple cohorts derived from different parents. This results in a cumulative released population that has gene frequencies representative of the original wild stock. Where the analysis of stock structure indicates that there is more than one population unit in the fishery, juveniles should only be released in the area where the broodstock were collected. This will involve applying the protocols outlined above to separate groups of broodstock from each population unit.

Requirements of released juveniles. The cultured juveniles must be released in ways and at times where they can avoid predators and find food to ensure their greatest possible chance of surviving and contributing to spawning biomass. This involves sound understanding of the distribution and abundance of their predators, and identification of nursery habitats that provide protection. Field experiments should then be done to identify optimal release strategies (Blankenship and Leber 1995).

Quarantine procedures. All batches of cultured juveniles to be released should be tested to ensure that they meet acceptable levels for pathogens and parasites prior to stocking. This will not only help safeguard the remnant wild stock against any diseases promoted under hatchery conditions, but it will also reduce risks to other species because pathogens are often more virulent in atypical hosts (Munro and Bell 1997 and references therein).

Management measures to maximize benefits. Investment in hatchery production will be wasted unless measures are taken to manage juveniles released in a restocking program. This will often involve a total moratorium on the catching of species until there has been recovery of spawning biomass to the desired level. However, this is not easy when the species under restoration is part of a multispecies fishery and vulnerable as by-catch. In such cases, gear modifications, and spatial and seasonal closures for fisheries or other species may also be needed to protect target species. An effective moratorium on the capture of target species until replenishment occurs is likely to cause short-term hardship for fishers. Thus, it is important to explain to them the longer-term benefits of restocking and the need for restraint, otherwise, many people may assume that the release of animals means that there will now be more to catch. It is also important to let fishers know that future harvests will have to be set at lower levels, otherwise, overfishing and stock reduction will reoccur.

Allocation of property or access rights to fishers prior to the moratorium will provide them with the incentive to comply because they will be the ultimate beneficiaries. However, the hardship that a restocking program imposes on fishers in the short to medium-term needs to be recognized. If necessary, other incentives may need to be provided to create alternative, related livelihoods (e.g., aquaculture). Where such resources or occupations are unavailable, well-enforced temporary exit arrangements with appropriate financial compensation may be necessary.

Determining the contribution of restocking to recovery. An important part of responsible application of a restocking program is to measure the success of intervention, to be certain exactly how recovery occurred and to determine the contribution made by restocking. A genetic tag is needed for this purpose, because the F1, F2, F3, etc. generations derived from released animals must be tracked so that their contribution to the restored biomass can be assessed compared to those individuals derived from the original remnant wild stock.

How does Stock Enhancement Differ from Restocking?

Whereas restocking is a potential tool for restoring the spawning biomass of a severely overexploited fishery, stock enhancement is intended to increase and / or stabilize the production of an operational fishery. Stock enhancement is a process used to overcome recruitment limitation, which occurs when the natural supply of juveniles fails to fill the carrying capacity of the habitat (Doherty 1999; Bell, in press). The result of recruitment limitation is that nursery habitats usually do not support as many juvenile fish and invertebrates as they could. Stock enhancement can help to correct this situation by adding more juveniles to optimize production from fishery (Bell, in press).

Information Needed to Assess the Potential Benefits of Stock Enhancement

As described above, stock enhancement should only be contemplated where there is good evidence that production is often limited by recruitment limitation. Large variation in the abundance of juveniles settling among years, continued rapid growth of new recruits and the persistence of strong year-classes are strong indicators that the habitats could support more juveniles than they receive naturally (Munro and Bell 1997; Doherty 1999). A prime task of managers considering stock enhancement is to identify those years where insufficient juveniles occur naturally to produce optimum yields. This must be done as early as possible in the settlement season using well-designed sampling programs for assessing the abundance of settling postlarvae. The process for determining how many juveniles are required to optimize production each year is explained in detail by Bell (in press). The important points to note about the process of stock enhancement are that: (1) it can provide managers with the ability to manipulate the age-structure of a fishery to create optimum harvest regimes; and (2) in most cases, careful consideration of how many juveniles to add will result in release of fewer juveniles than the habitat can support that year.

Other Components of a Responsible Stock Enhancement Program

Many of the steps involved in developing and implementing a stock enhancement program in a responsible way are the same as those outlined above for restocking programs above (but see also Blankenship and Leber 1995). A key difference to restocking, however, concerns management of released animals. In contrast to restocking, the management of stock enhancement programs needs to pay more attention to the number of juveniles released, to supporting measures to increase productivity, and to the development of regulations to optimize the biological, social and financial sustainability of the fishery.

In general, enhanced stocks do not require specialized management, provided the animals are released at the size, and in the habitat and time of year, that optimizes survival and cost. The cultured animals simply add to the stock available for capture and should be managed together with the wild individuals to maximize yield per recruit using conventional measures. However, several aspects of management, which may need particular attention, are as follows:

Maintaining a sufficient spawning biomass for replenishment. Excessive harvests of adults will reduce the scope for natural replenishment and increase the cost of producing cultured juveniles to provide the optimum number of one-year old animals each year. Thus, any perception on the part of fishers that the release of juveniles can be relied on to correct excess harvesting must be combated by monitoring of capture regulations.

Rotational fishing. An additional measure used to assist natural replenishment in some fisheries, e.g., for scallops in Japan (Masuda and Tsukamoto 1998), is rotational fishing. This management tool provides ample opportunity for reproduction when the number of areas fished sequentially exceeds the number of years it takes the species to reach maturity.

Integration with aquaculture. Opportunities for stock enhancement can be expected from some of the current initiatives to use wild-caught juveniles for aquaculture (Hair *et al.* 2002). For example, proposals to use the settling larvae of rock lobsters (puerulus) for aquaculture in Tasmania, Australia, has led to arrangements where a greater proportion of puerulus than would survive normally are to be returned to the wild at a larger size by farmers, thus enhancing the stock (D. Mills, pers. comm.).

Artificial habitats. For certain species, production can be increased further by providing additional habitat or reducing predation. Inshore herbivorous species associated with hard substrata, e.g., abalone, turban snails and sea urchins, are obvious candidates for increase of production through addition of artificial substrata. The artificial structures capable of providing additional habitat for a wide range of species are described by Grove *et al.* (1994) and Morikawa (1999).

Removal of predators. More productive conditions can also be created for some species by actively removing predators. This has been done effectively for enhanced scallop fisheries in Japan (Ventilla 1982). However, such manipulations should be guided by sound judgements about the overall effects on the ecosystem (FAO 2003).

Status and Potential for Restocking and Stock Enhancement in the Philippines

As outlined above, a key prerequisite for including restocking or stock enhancement among the measures available to managers to restore and increase the production of coastal fisheries is availability of large numbers of cultured juveniles. In many, but certainly not all, cases this will depend on cost-effective methods for the mass production of juveniles in hatcheries. The Philippines is well positioned to supply juveniles of several species, and to develop hatchery technology for others. The status of hatchery technology for marine invertebrates in the Philippines is summarized in Table 1.

The culture of giant clams in the Philippines was started in 1985 by the University of the Philippines-Marine Science Institute (UP-MSI) in collaboration with the Silliman University Marine Laboratory in Dumaguete City and the Australian Centre for International Agriculture Research (ACIAR). Production of juvenile giant clams in a responsible way has now been in progress for many years and restocking efforts for *Tridacna gigas* are currently in progress in various parts of the country.

Culture of the sea cucumber, *Holothuria scabra,* is still at the research and development stage. However, there are plans to transfer technology from elsewhere

Table 1. Status of hatchery technology for marine invertebrates in the Philippines.

Species	Status of Hatchery Methods	Institutions	Restocking and Stock Enhancement Applications	References
Giant clams *(Tridacna gigas, T. derasa, T. squamosa, T. maxima, T. crocea, Hippopus hippopus, H. porcelanus)*	Hatchery and ocean nursery methods developed since 1985	UP-MSI in collaboration with SEAFDEC, Silliman University, NGOs	Restocking of *T. gigas* and *T. derasa* at various locations in the Philippines, e.g., Silaqui Island, Hundred Islands (Pangasinan), Puerto Galera (Oriental Mindoro), Fortune Island, Arthurs Rock (Batangas), Sanga-Sanga (Tawi-Tawi), San Salvacion Island, Subic Bay (Zambales) and Kalayaan Islands (Palawan)	Gomez and Belda (1988); Mingoa-Licuanan and Gomez (1996); Surtida and Buendia (2000);SEAFDEC (2001)
Sea cucumber (*Holothuria scabra*)	Hatchery methods under development at experimental scale	UP-MSI	Proposed restocking in Lingayen Gulf (Pangasinan) as part of the Fisheries and Ocean Resources Governance Project; possibly also in Quezon province and Mindanao	P. Aliño and A. Uychiaoco (pers. comm.)
Sea urchin (*Tripneustes gratilla*)	Hatchery and growout methods developed since 1996	UP-MSI	Restocking at Bolinao (Pangasinan)	Juinio-Meñez *et al.* (1998); SEAFDEC (2001)
Abalone (*Haliotis asinina*)	Hatchery and growout developed since 1997; artificial diet developed in 1998 to tag juveniles prior to restocking; experimental restocking methods under development	SEAFDEC	Sagay Marine Reserve	SEAFDEC (2001)
Top shell (*Trochus niloticus*)	Hatchery developed since 2000; "diet-tagging" methods also developed in collaboration with a private hatchery in Palawan; experimental restocking methods under investigation	SEAFDEC	Sagay Marine Reserve (Negros Occidental)	SEAFDEC (2001)
Window-pane shell (*Placuna placenta)*	Experimental restocking methods under development	SEAFDEC	Panay Gulf	SEAFDEC (2001)
Shrimp (*Penaeus monodon*)	Hatchery and growout methods well developed	SEAFDEC	None to date	Primavera (1993); Surtida (2000)
Mud crab (*Scylla* sp.)	Technical and economic feasibility of hatchery and growout methods currently being tested	SEAFDEC	None to date	Agbayani (2001)

in the region to restock depleted populations of this species in Lingayen Gulf, Quezon province and Mindanao if assessments indicate that this form of management is warranted.

The propagation and growout of the sea urchin, *Tripneustes gratilla*, have also been underway at UP-MSI. Current efforts to restock this species to establish a viable spawning population have shown positive results at a marine park in Bolinao, Pangasinan.

At the Southeast Asian Fisheries Development Center (SEAFDEC), adoption and refinement of hatchery production techniques are underway for abalone (*Haliotis asinine*), top shell, (*Trochus niloticus)* and window-pane shell (*Placuna placenta*). For abalone and top shell, restocking experiments are in progress at a marine reserve in Sagay, Negros Occidental. An artificial diet has been developed to "diet-tag" juveniles of these two species prior to restocking. Research involving window-pane shell is focused mainly on developing restocking techniques in Panay Gulf. There, adult wild shells are stocked in pens in an attempt to increase spawning success.

SEAFDEC has also developed hatchery and culture technologies for shrimp, *Penaeus monodon*, and mud crab, *Scylla serrata*. Although this technology was developed to provide "seed" for growout in aquaculture, it could also be used for stock enhancement programs if the need arises.

References

Agbayani, R.F. 2001. Production economics and marketing of mud crabs in the Philippines. Asian Fish. Sci. 14(2): 201-210.

Barut, N.C., M.D. Santos and L.R. Garces. 1997. Overview of Philippine marine fisheries, p. 62-71. *In* G. Silvestre and D. Pauly (eds.) Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

Bell, J.D. (In press). Management of restocking and stock enhancement programs: The need for different approaches. Proceedings of the Second International Symposium on Stock Enhancement and Sea Ranching, January 2002, Kobe, Japan.

Bell, J.D. and D. Jamu. (In press). Assessing the potential for restocking, habitat enhancement, fish sanctuaries and aquaculture to restore production of *Chambo* in Malawi. Proceedings of the Malawi National Strategy to Restore Production of *Chambo*.

Blankenship, H.L. and K.M. Leber. 1995. A responsible approach to marine stock enhancement. Trans. Am. Fish. Soc. Symp. 15: 167-175.

Doherty, P.J. 1999. Recruitment limitation is the theoretical basis for stock enhancement in marine populations, p. 9-21. *In* B.R. Howell, E. Moksness and T. Svasand (eds.) Stock enhancement and sea ranching. Fishing News Books, Blackwell Science, Oxford, UK.

FAO (Food and Agriculture Organization). 2003. Fisheries management 2. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries 4 (Supplement 2). FAO, Rome. 112 p.

Gomez, E.D. and C.A. Belda. 1988. Growth of giant clams in Bolinao, Philippines, p. 178-182. *In* J.W. Copland and J.S. Lucas (eds.) Giant clams in Asia Pacific. ACIAR Monogr. No. 9.

Grove, R.S., M. Nakamura, H. Kakimoto and C.J. Sonu. 1994. Aquatic habitat technology innovation in Japan. Bull. Mar. Sci. 55: 276-294.

Hair, C., J. Bell and P. Doherty. 2002. The use of wild-caught juveniles in coastal aquaculture and its application to coral reef fishes, p. 327-353. *In* R.R. Stickney and J.P. McVey (eds.) Responsible marine aquaculture. CAB International, New York, USA.

Hall, S.J. 1999. The effects of fishing on marine ecosystem and communities. Fish Biology and Aquatic Resources Series I. Blackwell Science, Oxford, UK. 274 p.

Heppell, S.S. and L.B. Crowder. 1998. Prognostic evaluation of enhancement programs using population models and life history analysis, p. 495-507. *In* C. Coleman, J. Travis and A.B. Thistle (eds.) Proceedings I of the International Symposium on Fisheries Ecology - Marine Stock Enhancement: A New Perspective. Bull. Mar. Sci. 62. Rosenstiel School of Marine and Atmospheric Science, Florida, USA.

Juinio-Meñez, M.A., N.D. Macawaris and H.G. Bangi. 1998. Community-based sea urchin (*Tripneustes gratilla*) growout culture as a resource management tool. *In* G.S. Jamieson and A. Campbell (eds.) Proceedings of the North Pacific Symposium on Invertebrate Stock Assessment and Management. Can. Spec. Publ. Fish. Aquat. Sci. 125: 393-399.

Masuda, R. and K. Tsukamoto. 1998. Stock enhancement in Japan: Review and perspective. Bull. Mar. Sci. 62: 337-358.

Mingoa-Licuanan, S. and E.D. Gomez. 1996. Giant clam culture, p. 281-299. *In* S. De Silva (ed.) Perspectives in Asian fisheries. Asian Fisheries Society, Makati City, Philippines. 497 p.

Morikawa, T. 1999. Status and prospects on the development and improvement of coastal fishing ground. FAO Fish. Circ. No. 943: 136-239.

Munro, J.L. and J.D. Bell. 1997. Enhancement of marine fisheries resources. Rev. Fish. Sci. 5(2): 185-222.

Pauly, D., G. Silvestre and I.R. Smith. 1989. On development, fisheries and dynamite: A brief review of tropical fisheries management. Nat. Resour. Modelling 3(3): 307-329.

Primavera, J.H. 1993. A critical review of shrimp pond culture in the Philippines. Rev. Fish. Sci. 1: 151-201.

SEAFDEC (Southeast Asian Fisheries Development Center). 2001. Philippine experiences in stock enhancement and resource management. SEAFDEC Asian Aquacult. 23 (5-6): 26–33.

Silvestre, G. and D. Pauly. 1997. Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

Silvestre, G., L. Garces, V. Christensen, L. Lachica-Aliño and D. Pauly. (In press). Coastal fishery resources in developing Asian countries: Analyses of stock decline, species assemblages and trophic structures. In G. Silvestre, L. Garces, C. Luna, M. Ahmed, R.A.V. Santos, L. Lachica-Aliño, V. Christensen and D. Pauly (eds.) Assessment and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc.

Surtida, M.B. 2000. Trochus: the mollusk for button. SEAFDEC Asian Aquacult. 22 (4): 21.

Surtida, M.B. and R.Y. Buendia. 2000. Farming the giant clam. SEAFDEC Asian Aquacult. 22 (4): 18-19.

Talaue-McManus, L. 2000. Transboundary diagnostic analysis for the South China Sea. EAS/RCU Tech. Rep. Ser. No. 14. UNEP, Bangkok, Thailand.

Ventilla, R.F. 1982. The scallop industry in Japan. Adv. Mar. Biol. 20: 309-382.

Olango Birds and Seascape Tour: A People-oriented Ecotourism Venture[1,2]

MA. MONINA M. FLORES
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

A large amount of human and financial resources have focused on augmenting, supplementing and offering alternative livelihood to fishers. These investments have been through both government and nongovernment agencies. Despite some successes, most alternative livelihood activities have not really offered long-term solutions to fisheries management problems, such as reduction of effort and offering a total alternative to fishing.

The Coastal Resource Management Project (CRMP) of the Department of Environment and Natural Resources had a series of lessons and experiences in offering alternative and supplemental livelihood activities. Based on the lessons, it was found that developing the capacity of communities in running natural ecotourism activities was the most successful and sustainable intervention of the project. The Olango Birds and Seascape Tour (OBST) is one such experience of the project and the community working together in ecotourism.

The Tour

OBST is an ecotourism business venture in the island of Olango, Cebu Province. Residents of Suba, a fishing village in Olango Island, own and operate it. The business successfully integrates the elements of full community benefit and participation, contribution to environmental conservation and education, product differentiation and marketability, economic viability and promotion of local culture.

OBST started in March 1998 and was made possible through CRMP which is supported by the United States Agency for International Development. The goals of the project were to:

1. develop environment-friendly livelihood alternatives for resident fishers;
2. model sustainable tourism development in islands as a strategy for improving coastal management by local stakeholders; and
3. promote local cooperation in the conservation of natural protected areas.

The ecotourism venture is built around the unique environmental attributes and serene beauty of Olango Island's coast, seas, reefs and bird life (Sotto *et al.* 2001). Bird watching, coastal trekking, canoe paddling, snorkeling, swimming, visiting seaweed farms and island hopping are among the low-impact recreational activities offered.

The tour promotes and showcases local conservation of threatened coastal habitats and marine and bird life in particular. Tourists can also snorkel and witness the abundance of fish in a coral reef that has been declared by the local government, and is managed by the community, as a marine sanctuary.

The project showcases the potential viability and benefits of full community participation in the ownership and operation of ecotourism ventures. By actively managing a portion of the protected area, the community has gained substantial economic benefits through entrance fees and provision of multiple services. The community also has gained a growing sense of pride, technical skills and confidence in its members' ability to provide a better future for themselves and their children.

---

[1] This paper can be cited as follows: FLORES, M.M.M. 2004. Olango birds and seascape tour: A people-oriented ecotourism venture, p. 252-255. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.
[2] This contribution is updated from Flores (2001).

Olango Island

Olango is near Mactan Island, the second largest tourist area in the Philippines (Figure 1). Mactan has an international airport, five-star resorts and numerous tourism businesses. Olango's proximity to Mactan and Cebu City adds to the island's potential as a tourism destination. Mainland Olango's flat and elongated dry land measures about 1,000 ha. The intertidal wetland, known as the Olango Island Wildlife Sanctuary (OIWS), extends the island further south by 904 ha. The OIWS is the first area in the Philippines to be listed in the Ramsar List of Wetlands of International Importance, a recognition of its importance as a wetland for birds belonging to the East Asia Migratory Flyway (Figure 2). An extensive, submerged reef that connects the island to other islets, surrounds Olango. One of these islets is Gilutongan Island, with a protected reef that serves as a strategic spawning ground for marine organisms and is an increasingly popular destination for diving, snorkeling and swimming.

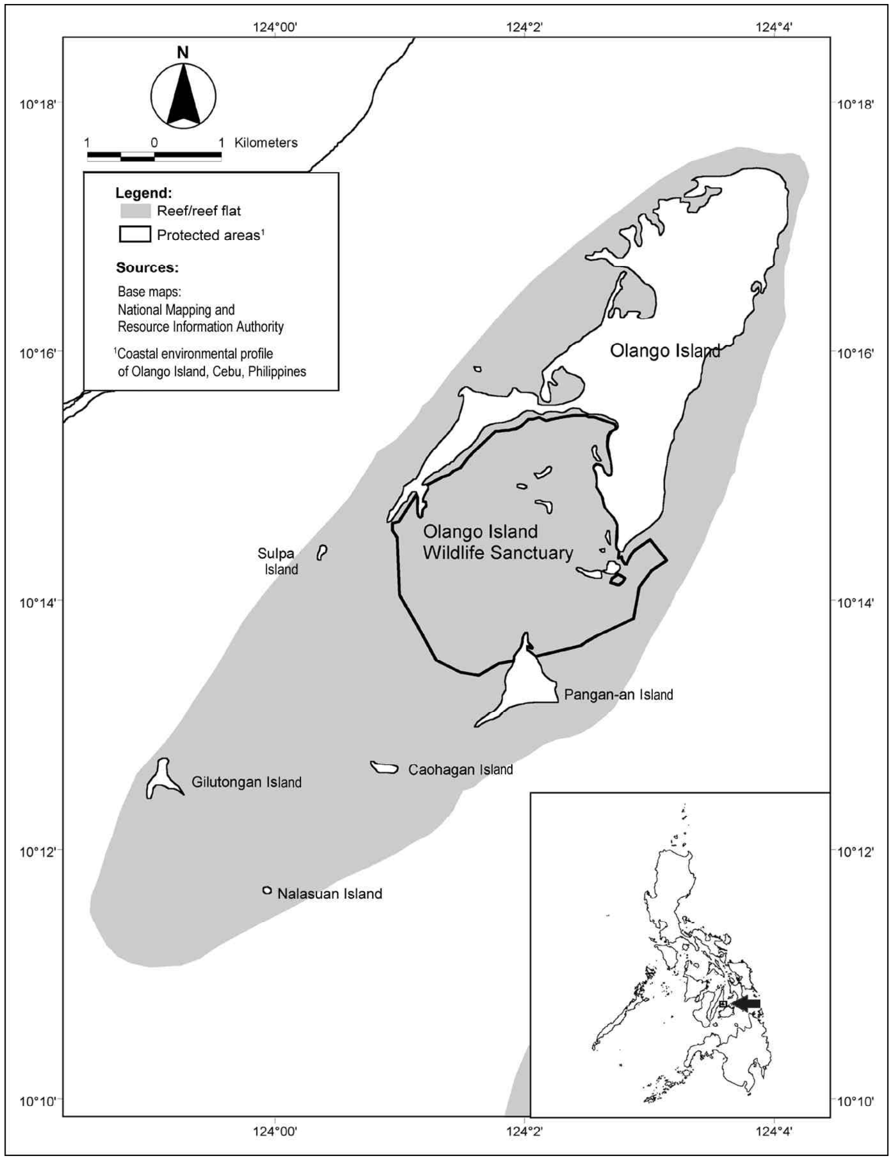


Figure 1. Olango Island.

Of Olango's approximately 23,000 residents, 75% are dependent on fishing and related activities, such as harvesting of shells, starfish, sea cucumbers, sea urchins, tropical aquarium fish, live food fish, corals, mangroves and others. Olango's fisheries have declined considerably due to overfishing and destruction of coastal habitats by cyanide and dynamite fishing. Declining resources, high population density and insufficient basic service delivery all contribute to low income, low education and low occupational mobility of fishing families in Olango (Sotto *et al.* 2001). Earlier initiatives in coastal tourism development marginalized the community in terms of participation in decision-making and benefit-sharing.

Tour development steps and strategies

In Olango, the challenge was to assist the community and key public and private stakeholders in the island by introducing sustainable tourism through a participatory development framework (Huttche and Flores 2002). OBST went through five stages of development prior to becoming functional in 2000. The stages ran parallel to a basic coastal management planning framework which included participatory assessments, planning and implementation of coastal management initiatives such as the marine sanctuary in Gilutongan. Following are the five stages:

1. Assessment - A rapid survey of Olango's resources determined product options for enterprise development, including ecotourism products that have low environmental impact, marketability and community benefit.
2. Participatory ecotour product development - Meetings and workshops were conducted with community members interested in the project to

Figure 2. Birds feeding on the mudflats of Olango are a centerpiece of the tour.

orient them on the nature and potential benefits, constraints and problems related to ecotourism development.

3. Development of linkages – These were established with public institutions and tour companies for marketing, policy, program and promotional support.
4. Capability-building – The community's capacity in tour operations and business development was strengthened.
5. Transfer of business administration to community - Two years after the project started, the community assumed full control of the administration of tour operations and formalized collective ownership of the business.

The factors that have contributed to the success of OBST were strategies of implementation that considered the sociocultural, marketing, environmental and stakeholder partipation needs and aspects of the tourism enterprise.

Key sociocultural strategies consisted of:

1. orientation of the product around the use of local skills, everyday activities, local crafts / arts and music;
2. community ownership of the tour product;
3. participatory processes and mechanisms;
4. implementation of a training strategy of "learning by doing";
5. delivery of immediate economic returns;
6. spreading benefits through local sourcing of services and goods;
7. support of community organization to influence planning and policy development through high media profile, generation of multi-institutional support and endorsements by visitors; and
8. managing the number, frequency and behavior of visitors, community users of the natural resource, and other development interests within the locality.

Marketing strategies included:

1. tapping the development sector as the primary market to jumpstart and test-run the educational tour with visitors;
2. developing a tour product to capture tourist segments from resorts and hotels in nearby Cebu City;
3. designing the tour product to capture niche markets;
4. making OBST different from existing tours by providing expert interpretation, interaction with coastal villages, visit to a marine sanctuary and other nature and culture-based activities; and
5. making OBST the country's leading community ecotourism product.

Environmental strategies consisted of:

1. promotion of shoreline management among landowners, residents and public resource managers;
2. implementation of participatory resource assessment, integrated coastal management and ecotourism planning;
3. formulation and implementation of resource use guidelines;
4. designing the tour as a low-impact itinerary; and
5. a training and accreditation system with strong emphasis on environmental consciousness and practice.

To ensure sustainability, during OBST's second year of operation, CRMP established marketing support and environmental management systems, and began preparations for its exit from the project. Mechanisms were developed for booking services under co-management by the community and its partners outside the island; networking with tour


Figure 3. Daily community activities form a key part of the tour, giving it a local flavor.

Table 1. OBST visitors since 2001.

Tourists	2001	2002
Local	196	209
Foreign	51	410
Total	247	619
Nationality	15	19

operators, guides, hotels and resorts; and building community capability in, and understanding of, the marketing of the product.

Primary emphasis was given to CRM as a motive and tool for sustainability. A proposal was presented to the government agency in charge of managing OIWS, seeking to deputize the cooperative to assist in protection, rehabilitation and research activities at the sanctuary. CRMP saw that the long-term sustainability of OBST depended on its integration into OIWS' comprehensive management plan, enforcement of environmental laws outside the sanctuary boundaries and harmonization of land use practices in adjacent villages.

CRMP phased out from providing technical assistance to the community tourism project in December 2000, allowing the community and local institutions to begin to manage the enterprise on their own. CRMP monitored the project briefly before fully leaving its management to the community and sharing lessons with a broader audience.

Conclusion

OBST has prospered under its own management and generated substantial income for the participating community. It has been able to do this within the legal context of a national park under the direction of DENR. The local community established their own links with the nearby resorts and eventually their own booking office both on the island and on Mactan Island.

An important factor in the ongoing success of OBST organization is its good rapport with nearby resorts on Mactan Island, which promote the tour among their guests (Table 1). The resort managers are proud they can send their guests to a well-managed tour run by the local community (Figure 3). Through this collaboration, OBST is providing one of the few viable options to redistribute wealth directly from the larger resorts and their occupants on Mactan Island to the Olango Island community.

For coastal and fisheries management, the tour has succeeded in tying the life of the local resource users more intricately with resources around them. The community now has a clear incentive to protect and manage the resources, while making a sustainable income from them. This is a key factor which should sustain the organization and the resources through the future.

References

Flores, M.M.M. 2001. Olango birds and seascape tour: A people-oriented ecotourism venture. Tambuli: A publication for coastal management practitioners 7(September): 23-25.

Huttche, C. and M. Flores. 2002. Sustainable coastal tourism handbook for the Philippines. Coastal Resource Management Project, Cebu City, Philippines. 144 p.

Sotto, F.B., J.L. Gatus, M.A. Ross, M.F.L. Portigo and F.M. Freire. 2001. Coastal environmental profile of Olango Island, Cebu, Philippines. Coastal Resource Management Project, Cebu City, Philippines. 129 p.

Challenging the Status Quo of Marine Capture Fisheries Management: The Need for Public Education and Policy Advocacy Programs[1]

REBECCA PESTAÑO-SMITH
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Background

Marine capture fisheries management is a complex, often controversial, matter that is affected by biological, socioeconomic and political factors. Open access, overexploitation and overcapitalization of fisheries are interrelated issues/problems that have strong implications in the formulation of national policies and local implementation initiatives for sustainable fisheries. Failure to appreciate and understand the basic concepts, biology and dynamics of these interrelated issues and the continued lukewarm implementation of the Philippine Fisheries Code (PFC) of 1998 will only result in continued depletion of marine fisheries resources, and subsequently, displacement of commercial fishers and their workers and impoverishment of municipal fishers.

The importance of marine capture fisheries to food security in the Philippines is well documented. In 2000, the Coastal Resource Management Project (CRMP) of the Department of Environment and Natural Resources funded by the United States Agency for International Development contributed to this stock of knowledge and information by contracting an independent private research group to conduct a nationwide quantitative survey to benchmark the current fisherfolk's knowledge, attitudes and practices on fisheries and coastal resource management (CRM) (CRMP/MBL Trends 2000). A total of 700 fisherfolk from 16 provinces in the country were interviewed for the study. The results affirm the heavy dependence on fish and fishing as a primary source of daily food and livelihood, respectively, for Filipinos. Specifically:

- 89% of respondents cited their own catch from the sea as the source of their largest portion of food;
- 82% feed their families daily from their fish catch; and
- 60% claim 75-100% of their total income comes from fishing.

Out of the three most urgent personal concerns, 74% identified having enough to eat every day as their top concern, followed by health of family members (64%) and provision of schooling to children (62%).

Majority of respondents cited all major indicators of overfishing as becoming worse over the last three years with: 70% - increased time to catch a kilo of fish; 74% - decrease in the number of fish caught; 68% - smaller fish are being caught; and 74% - decrease in quality of fish caught.

Historically, however, in spite of studies on stock assessments that show major bays in the Philippines are already overfished, as well as testimonies of fisherfolk about declining fish catch and increased fishing effort, marine capture fisheries issues are not factored significantly in the food security programs of the national government (Courtney *et al.* 1999). When compared to the agricultural sector, marine capture fisheries issues are not perceived as urgent management problems requiring national attention and solutions. In fact, up to the present time, the response of government has been largely to promote increased efficiency in fishing effort or to invest in aquaculture

---

[1] This paper can be cited as follows: PESTAÑO-SMITH, R. 2004. Challenging the status quo of marine capture fisheries management: The need for public education and policy advocacy programs, p. 256-260. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

rather than to introduce or enhance management measures.

Philippine sociologists and anthropologists agree that mindsets and worldviews of fishing communities are largely shaped by their natural and ecological conditions as well as the need to continually adapt to challenges of survival. To a large extent, the open access regime and the element of "uncertainty" that characterizes fishing operations have led to indiscriminate fishing and subsequent deterioration of fishing grounds and habitats (Ushijima and Zayas 1994).

Coastal and marine resources have generally been viewed as a "common property" to be shared by all. However, as pointed out by fisheries and social scientists, marine resources are not equally distributed in the sea, with fish tending to aggregate and concentrate in certain fishing grounds and habitats, not to mention the contributing factors of seasonality and weather conditions. As such, social scientists say that given the vagaries of fishing operations, each fisher tries to gain the largest profit for himself by employing different strategies to take the most from the sea. This is evident in efforts by fishers to continually adapt their gears towards higher efficiency and the drive for individual competition to increase productivity to sustain their livelihood (Yano 1994).

It is the premise of this paper that arresting or reversing marine capture fisheries decline will not get anywhere in the Philippines without a paradigm shift in the management orientation and social norms towards fisheries. Solutions to marine capture fisheries problems cannot adequately happen with the existing social, political and economic norms and policies that favor an open access regime and "efficiency in fishing effort" mindset. What is urgently needed is to challenge the status quo of marine capture fisheries development and management and move towards a framework anchored on the principles of sustainable development and social equity. As pointed out by several fisheries and social scientists, the resolution of the problems facing Philippine marine capture fisheries today should be pursued not just by addressing resource decline, but also by aggressively implementing the policy bias in favor of small-scale, marginal fishers.

It is agreed of course that simply mandating fisheries management as a matter of national policy is not enough to arrest, much less reverse, continuing fisheries decline. A transformation among all sectors of society is required, and it demands a good understanding of intended change, exercise of political will and strong leadership. Such transformation requires a lot of time (Ferrer 1989). It is a race against time and a race that must be won.

Challenging the status quo of marine capture fisheries management and development is a task that can be jumpstarted by systematic and strategic information, education and communication (IEC) programs. IEC plays a key role in helping attain resource management objectives through its ability to provide information and knowledge on important ecological and resource management concepts, effect individual and collective action as well as promote and/or reinforce social norms. IEC is also an effective tool to help achieve policy goals and promote participation of community members and stakeholders through participatory and informed decisionmaking processes. The immediate tasks for IEC in challenging the status quo of marine capture fisheries management and development are the demystification of its open-access (Figure 1) and production-oriented paradigm, as well as the provision of research-based information that accurately and vividly present the true picture of Philippine fisheries. For example, results of stock assessment combined with indigenous knowledge of fishers must be made available and understandable to resource users and fisheries/CRM managers.

IEC Tasks at Hand: Mainstreaming and Agenda-Setting

Challenging the status quo of marine capture fisheries management and development calls for the twin strategies of mainstreaming and agenda-setting (Smith *et al.* 2000). Traditionally ascribed as a mass media function, agenda-setting is the process by which problems become salient as political issues meriting the attention of the larger public (Wallack 1992; Cook *et al.* 1993). Its primary objective is to focus the spotlight on a particular issue and extend the attention to its illumination (Wallack 1992). The key objective of agenda-setting is to promote fisheries management issues into the forefront of national and public attention.

To begin with, through the use of mass media, large group interventions and popularized information, a generalized belief regarding the true conditions about declining fish catch and its related issues/concerns must be effected to transform perception of these issues into a widely recognized problem that warrant political and public attention. As observed by political scientists, "the identification of a condition such as deteriorating coastal resources is not the same as the definition of a problem that requires attention and response. Conditions become defined as problems when we come to believe that we should do something about them" (Tobin 1992).

Along this line, systematic, strategic and continuous visibility of fisheries / CRM issues / stories in mass media and public forums must be undertaken and appropriately framed to illustrate the role of marine capture fisheries in the Philippine food security equation. Coastal resource and fisheries management issues must be presented in various mass, group and special media and in messages accessible and acceptable to a broad spectrum of audiences.

Mainstreaming, on the other hand, is a strategy for making a particular perspective / approach or program an integral dimension in all decision-making processes and allocation of resources, thereby contributing to a profound organizational transformation (UNDP 1998). Where fisheries are concerned, efforts must be undertaken to imbue fisheries and CRM-mandated institutions with the necessary resource management and sustainable development perspectives and skills to take relevant and management-directed, rather than production-directed actions or programs. Falling within the realm of institution building and capacity development, donor-funded projects and international organizations can serve as effective catalysts for such organizational transformation. Mainstreaming fisheries management is particularly critical in the areas of law enforcement and national policy implementation.

Need for Law Enforcement to Go Hand in Hand with IEC

Asking fisherfolk to stop or modify their behaviors, though it is in their best interests in the long term, has instant negative rewards for them (fishing puts food on the table and money in the pocket). It is not a coincidence that the population sectors with the highest poverty are at the two ends of the watersheds – the forest folk and the coastal folk – both highly resource-dependent populations with very little alternatives in the form of secure employment. It is possible to make minor modifications in individual behavior. For example, persuading fishers to change the size of their nets, to fish seasonally or only keep fish of a particular size, or to limit fishing to a well-defined area to allow other habitats to restore themselves, may rely on voluntary changes in behavior.

However, the "bigger" behavior changes, such as stopping dynamite or poison fishing, or intrusion of commercial fishing in municipal waters, are largely

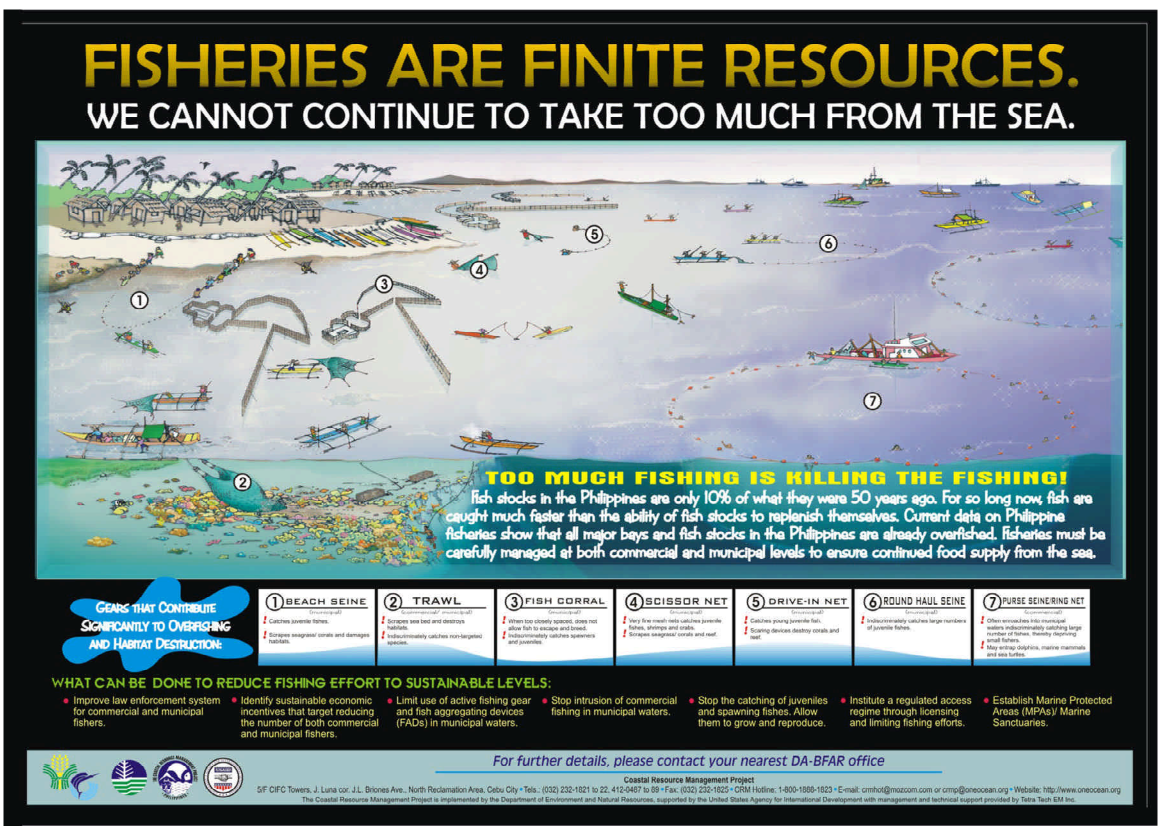


Figure 1. IEC posters, such as this, help demystify the prevailing open-access paradigm of Philippine fisheries.

involuntary, triggered by regulatory and enforcement measures. These measures can mandate involuntary behavior change and in the short run, may be the most effective way to proceed. When consistently done, it could effect large-scale involuntary behavior change to turn around the resource. However, current practices on enforcement leave much to be desired, and sustainability is a problem. As such, violations of fishery laws continue, with lamentably disastrous consequences to the resource.

In this regard, efforts to mainstream the enforcement of fishery laws within the framework of the Philippines' national enforcement and police program must be undertaken. Historically, fishery law enforcement has been a marginal function of law enforcement agencies. If the trend in the country's fast declining marine capture fisheries is to be reversed, "selling the law" and aggressive enforcement of fishery laws must go hand in hand with public education activities.

Fisheries Policy Implementation: Crossing the Threshold to Management

The advent of the Philippine Local Government Code (LGC) of 1991 and PFC of 1998 provided the legal and jurisdictional framework for fisheries management to be mainstreamed in the country. While in the past, efforts have been initiated by the national government to address illegal fishing, overfishing and habitat destruction through donor-funded or internally generated programs, it was the passage of these two codes that seriously opened the doors and windows of opportunity for the country to crossover from fisheries development towards fisheries management. The LGC and PFC underscored the role of local government units (LGUs) in managing municipal waters and nearshore fisheries.

Because of the historically limited attention given to fisheries as a resource management area, much remains to be done to re-engineer national and local government institutions, as well as assisting organizations towards a more proactive, precautionary and management approach to fisheries. To date, the weak implementation of PFC has not produced the intended result of managing the country's fisheries in a sustainable manner while allowing the greatest benefit to accrue to the largest number of people. Instead, municipal fishers have to continually fight for their legally mandated preferential use rights.

As such, a strong and sustained public education and advocacy program resulting in prioritization of fisheries issues and problems in national and local agenda is urgently called for. The national government should do well to redirect its efforts and investments toward implementing the social equity provisions of the code and to capacitate LGUs to effectively manage their municipal waters.

Moving Towards Behavioral Change

The CRMP / MBL Trends (2000) study showed a 60% level of fisherfolk awareness regarding their fisheries and willingness to embrace the range of management measures that would help safeguard the sustainable use and management of their resources. Contrary to perceptions of politicians that CRM programs would not be popular politically, the survey revealed that fisherfolk in general were receptive to fisheries management measures and would support the following:

- ban on the use of compressors in fishing (76% of respondents);
- imposition of heavier penalties for destructive fishing (71%);
- total ban in the entry of commercial fishing within 15 km of municipal waters (72%);
- establishment of marine sanctuaries in their localities (71%);
- delineation of municipal water boundaries (68%);
- establishment of a closed season during spawning periods of certain fishes (66%);
- delineation of use zones in municipal waters for specific uses (62%);
- restriction of conversion of mangroves into fishponds (61%);
- limiting use of fish aggregating devices, such as *payaw*, artificial reefs, etc. (60%); and
- limiting quantity of fish that may be captured or catch ceiling (50%).

Results of the study indicated that a shift in the perspective and mindset of fisherfolk stakeholders is now occurring, and a behavioral change towards more management measures is forming. The challenges and opportunities to help realize sustained behavioral changes towards marine capture fisheries now lie in the hands of Philippine policy / decisionmakers and program implementers.

Key Messages for Advocacy

The following facts as summarized from many position papers and policy studies continue to be relevant when advocating for marine capture fisheries management reforms in the Philippines. These can also serve as underlying themes or key messages in IEC materials / activities:

1. Fisheries are finite resources. We cannot continue to take too much from the sea. National policies must recognize the limits of fish as a biological resource.
2. We cannot continue to convert natural coastal ecosystems into "food machines" without regard or respect for the ecological laws that govern these ecosystems.
3. Livelihood and fish security for municipal fishers are recognized as the most effective strategies for successful and equitable management of Philippine fisheries.
4. Food security and poverty alleviation in coastal areas will only be achieved when illegal and destructive fishing is stopped; fisheries and coastal habitats are managed for sustainable use; and fishing pressure is reduced.
5. Philippine demersal and small pelagic stocks are substantively depleted, with current abundance levels in many fishing grounds down to 10-30% of their original levels recorded in the late 1940s.
6. Overfishing is both a local and global problem. Importing fish is only a short-term solution to dwindling domestic fish supply.
7. Too much fishing is killing the fishing. Highly efficient and indiscriminate fishing practices, gears and technology contribute significantly to depletion of fish stocks and other marine species populations.
8. Protecting critical coastal and marine habitats is a vital component to sustainable fisheries. Healthy habitats sustain healthy fisheries.
9. The absence of solid data is no longer an excuse to continue with indiscriminate fishing practices. Without solid evidence, a precautionary approach must be taken.
10. The Philippine Constitution and the 1998 PFC guarantee the preferential use rights of municipal waters to municipal fishers. The national government must exercise its policy bias for small-scale fishers and capacitate LGUs to effectively manage their municipal waters.

In the Philippines, as is true elsewhere in the world, time is of the essence. The strategic spread of sustainable fisheries and CRM is essential to prevent a general collapse of fisheries and coastal resources due to increased population pressure and rapidly rising demand for marine-based protein. As noted scientist, Dr. Sylvia Earle, observed, "Never before has a wake-up call from nature been so clear, never again will there be better opportunities to protect what remains of the ocean's wealth".

For the Philippines and its population of almost 80 million, "the seas are not yet empty, but the signs are not good". But it is not too late. With the appropriate sustainable development policies, broad public support and political will, we can still do it right with our marine capture fisheries.

References

Cook, F., T. Tyler, E. Goetz, M. Gordon, D. Protess, D. Leff and H. Molotoch. 1993. Media and agenda setting: Effects on the public, interest group leaders, policymakers and public policy. *In* L. Wallack, L. Dorfman, D. Jernigan and M. Themba (eds.) Media advocacy and public health. Sage Publications, California, USA.

Courtney, C.A., J.A. Atchue III, M. Carreon, A.T. White, R.P. Smith, E. Deguit, R. Sievert and R. Navarro. 1999. Coastal resource management for food security. Coastal Resource Management Project and Bookmark, Inc., Manila, Philippines.

CRMP (Coastal Resource Management Project)/MBL Trends. 2000. A quantitative study of the knowledge, attitudes and practices of fisher folks. Coastal Resource Management Project, Cebu City, Philippines.

Earle, S. As quoted in "Empty oceans". Empty Nets Series. www.habitatmedia.org.

Ferrer, E. 1989. People's participation in coastal area management, p. 117-127. *In* T.E. Chua and D. Pauly (eds.) Coastal area management in Southeast Asia: Policies, management strategies and case studies. ICLARM Conf. Proc. 19, 254 p.

Smith, R.P., C.A. Courtney, M. Grieser and A. Sia. 2000. Paper presented at the North American Association for Environmental Education Conference, August 1999, Ohio, USA.

Tobin, R.J. 1992. Legal and organizational considerations in the management of coastal areas, p. 93-105. *In* T.E. Chua and L.F. Scura (eds.) Integrative framework and methods for coastal area management. ICLARM Conf. Proc. 37, 169 p.

UNDP (United Nations Development Programme). 1998: *In* L. Corner. Capacity-building for gender mainstreaming in development. www.undp.org/gender.

Ushijima, I. and C. Zayas, Editors. 1994. Fishers of the Visayas. Visayas Marit. Anthropol. Stud. I, 1991-1993. University of the Philippines, Quezon City, Philippines.

Wallack, L.M. 1992. Media advocacy and public health. Sage Publications, California, USA.

Yano, T. 1994. The characteristics of fisherfolk culture in Panay from the viewpoint of fishing ground exploitation. *In* I. Ushijima and C. Zayas (eds.) Fishers of the Visayas. Visayas Marit. Anthropol. Stud. I, 1991-1993. University of the Philippines, Quezon City, Philippines.

Waters of Missed Understanding[1]

VIRGILIO B. SANTOS
Legal Division
Bureau of Fisheries and Aquatic Resources
Department of Agriculture, Quezon City
Philippines

Editor's note: Below is an incisive discourse on fisheries policy spiced with some historical flavor and unorthodoxy. Some readers might find the author's opinion strange while some might plainly agree. The opinions expressed in this paper do not necessarily reflect that of the Bureau of Fisheries and Aquatic Resources (BFAR) of the Philippine Department of Agriculture (DA).

The author first discusses the term "municipal waters" as it evolved in accordance with the overarching policies of the times. "Municipal waters" has been defined in three major laws: Presidential Decree (PD) 704 (Fisheries Decree of 1975), Local Government Code and Republic Act (RA) 8550 (An Act Providing for the Development, Management and Conservation of the Fisheries and Aquatic Resources, Integrating all Laws Pertinent Thereto, and For Other Purposes) or the Fisheries Code. For the untrained eye, the obvious change in the definition is the area of municipal waters. PD 704 maintained an area of 3 miles but this was expanded by the Local Government Code, and affirmed by the Fisheries Code, to encompass 15 km. The more sophisticated will notice subtle incongruities. The author shows how a seemingly "harmless" terminology can have grave implications on the enforcement of laws and policy implementation.

Towards the end, the author takes on the Fisheries Code and amply scrutinizes its more problematic provisions. He points out the various imperfections of the code thus providing some guidance on the elements that need to be changed, refined or improved.

Case 1: Philippine Waters and Municipal Waters

The Fisheries Code (RA 8550), on one hand, defines "Philippine waters" or "waters belonging to the State" to include all waters within Philippine territory, such as rivers, streams, creeks, brooks, ponds, swamps, lagoons, gulfs, bays and seas and other bodies of water now existing of which may hereafter exist in the provinces, cities, municipalities and barangays, and the sea or freshwater around, between and connecting the islands of the archipelago regardless of their breadth and dimensions, the territorial sea, the seabeds, the insular shelves and all other waters over which the Philippines has sovereignty and jurisdiction, including the 200-nautical mile exclusive economic zone and the continental shelf.

On the other hand, "municipal waters" which is also part of Philippine waters include not only streams, lakes and tidal waters within the municipality, not being the subject of private ownership and not comprised within national parks, public forests, timberlands, forest reserves or fishery reserves, but also marine waters included between two lines drawn perpendicular to the general coastline from points where the boundary lines of the municipality touch the sea at low tide and a third line parallel with the general coastline and 3 nautical miles from such coastline (Section 3-p, PD 704).

Rivers within the political jurisdiction of local government units (LGUs) cannot be claimed as part of their municipal waters as the same is found only in the definition of Philippine waters but not in municipal waters, a case of "what is not included is deemed excluded," similar to the Romanized *expresio unius est exclusio alterius* (the mention of one thing implies the exclusion of another thing). Lagoons are also found only in Philippine waters but not in municipal waters, besides which they are declared as belonging to the state under the Water Code of the Philippines (PD 1067).

Excluded likewise from municipal waters are bodies of water inside titled properties; thus, the phrase "not being the subject of private ownership" in the definition. Waters in fishpond areas covered by fishpond lease agreements are also not part of municipal waters.

---

[1] This paper can be cited as follows: SANTOS, V.B. 2004. Waters of missed understanding, p. 261-264. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

Case 2: Changes in Limits of Municipal Waters

The 3-mile municipal water radius was increased to 15 km from the shoreline under the Local Government Code (Section 131-r, RA 7160), which at once spawned the 15-km commercial fishing restriction. Although without legal basis, it was dubbed to be the official stand of DA-BFAR.

At the time the so-called "official stand" came into being, the restriction on commercial fishing was actually *pito* (seven) and *pito-pito* (seven-seven). Let us say that *pito* is "7 fathoms" so that *pito-pito* will become "7 fathoms plus 7 km". *Pito* covers all commercial fishing boats which are prohibited from operating in Philippine waters 7 fathoms deep or less (Section 1, PD 1016). *Pito-pito* applies only to three discriminated gear: commercial trawl and purse seine (Letter of Instruction 1328; Fisheries Administrative Order [FAO]156) and commercial *hulbot-hulbot* (modified Danish seine) using fine mesh net (FAO 164) which should operate not only in areas more than 7 fathoms deep but also beyond 7 km from the shoreline. If fine mesh net is not used in commercial *hulbot-hulbot* fishing, the restriction would be downgraded to only *pito,* which is for operating in waters only 7 fathoms deep or less.

The depth factor of "more than 7 fathoms" should be satisfied first before considering the distance factor of "more than 7 km from the shoreline." If the entire 15-km municipal waters are only 7 fathoms deep or less, fishing by means of commercial trawl, purse seine and *hulbot-hulbot* using fine mesh net should be conducted beyond the said municipal waters where the depth is more than 7 fathoms.

It is therefore rather strange how the 15-km commercial fishing restriction, bereft of any legal basis, could have become the DA-BFAR official stand and gained acceptance by the elitist academe and even given blessing by the officialdom when there is nothing in the definition of municipal waters in the Local Government Code expressly prohibiting commercial fishing therein, nor even a clause providing that only municipal fishing shall be conducted therein to imply that commercial fishing is out, much less a corresponding penalty for the imagined prohibition. Worst, the error has been perpetuated under the Fisheries Code.

What everybody missed is that the expansion of the municipal waters and the granting of the municipal fishery privileges in the Local Government Code are placed under Book II on Taxation, clearly suggesting that the intent and purpose of which is just to widen the base for the sourcing of local revenues through the granting of more fishery rights in the increased number of fishery zones or areas of the expanded municipal waters, because a bigger budget is essential to a stronger and better local governance. After all, RA 7160 is about the conduct of local governance and not for the regulation of fishing, much less commercial fishing.[2] Advocates of the false gospel soon found themselves in hot water when they tried to implement the same within their jurisdiction.

"Municipal waters" is now defined in the Fisheries Code as to "include not only streams, lakes, inland bodies of water and tidal waters within the municipality which are not included within the protected areas under Republic Act No. 7586 (the National Integrated Protected Area System law), public forests, timberlands, forest reserves or fishery reserves, but also marine waters included between two lines drawn perpendicular to the general coastline from points where the boundary lines of the municipality touch the sea at low tide and a third line parallel with the general coastline including offshore islands and fifteen (15) kilometers from the shoreline" (Section 4-58, RA 8550).

Noticeable are the three deviations in this definition from the previous ones:

- deletion of the phrase "not being the subject of private ownership";
- delimitation of protected areas under the NIPAS law; and
- insertion of the words "including offshore islands."

All the previous definitions of municipal waters carried the phrase "not being the subject of private ownership" to point out that waters inside titled properties do not form part of municipal waters. It is true that waters are owned by the state but once they enter private lands, ownership by the state ceases where the landowner's right to his property begins. Thus, cases of electro-fishing are being dismissed by the courts if it is found out that the venue of the offense is inside private lands. The water would revert to the state once it leaves the private land, thus, the owner of a private fishpond who would use chemicals to

[2] Two conflicting opinions on the issue of commercial fishing in the 15-km municipal waters prior to the enactment of the Fisheries Code are presented in the *Legal and jurisdictional guidebook for coastal resource management in the Philippines* (DENR *et al.* 1997).

eradicate it of predators has every right to do so since that is his property, but when the wastewater flows out of his land and pollutes the neighboring waters, he could be sued for aquatic pollution in violation of Section 102 of RA 8550, not for illegal fishing by means of poisonous or obnoxious substances in violation of Section 88.

Case 3: Archipelagic Principle and the Mapping of Municipal Waters

The most contentious is the insertion of the words “including offshore islands” in the delineation of the municipal water which the commercial fishing sector is interpreting as to mean that the 15-km municipal water radius should be reckoned from the shoreline of the mainland municipality, not from that of its outermost component islands and islets.

BFAR contends that the insertion of the subject words “including offshore islands” is only a grammatical lapse in its First Indorsement dated 6 August 1999, which suggested that the time-honored archipelagic principle be observed by the National Mapping and Resource Information Authority in the guidelines they will put out in delineating the municipal waters.

Constitutional compliance is mandatory in the hierarchy of laws. There is no legal basis to question why the archipelagic principle is only good in the national level but not in the local level to justify abandoning the archipelagic doctrine in the delineation of municipal waters. Furthermore, said principles have been enshrined and applied through the fishery law since 1986 and implemented via FAO Nos. 156 and 164.

Case 4: Misunderstandings of the Fisheries Code

This section discusses specific provisions of the Fisheries Code that may be perceived to be inconsistent with other provisions of the code as well as other policies, including the Constitution, impractical or difficult to implement, confusing, or resulting in problems of access, jurisdiction or enforcement.

First, there is the case of commercial fishing in municipal waters. As per Section 16, municipal waters are reserved for fishing by municipal fishers. However, small and medium-scale commercial fishing is allowed in municipal waters from 10.1 to 15 km, subject to certain conditions, notably:

- no commercial fishing in municipal waters with depth less than 7 fathoms as certified by the appropriate agency;
- fishing activities utilizing methods and gears that are determined to be consistent with national policies set by DA-BFAR;
- prior consultation, through public hearing, with the Municipal/City Fisheries and Aquatic Resources Management Council (M/CFARMC) has been conducted; and
- the applicant vessel as well as the shipowner, employer, captain and crew have been certified by the appropriate agency as not having violated this code, environmental laws and related laws.

This author opines that the conditions for commercial fishing in the designated areas are formidable. For one thing, the definition of terms in the code indicate that small-scale commercial fishing may use either passive or active gear while the medium-scale commercial fishing boats use only active gear. A condition in allowing this concession is that the gear to be used shall be consistent with national policies, and the use of active gear is banned inside the municipal waters (Section 90, Supra) which automatically disqualifies medium-scale commercial fishing as the same only use active gear. The other condition that needs to be satisfied is the holding of prior consultation through public hearing with M/CFARMC, which entails time and resources, and is marked with continuous debates before the matter is resolved.

A provision that might create anomalous activities is Section 18, which says that municipal waters shall be utilized only by municipal fisherfolk listed in the municipal registry, i.e., minimum of six months residency requirements. In the case of granting fishery privileges for *bangus* fry concessions or demarcated areas for mariculture, the LGU utilizes a bidding process. While the code recognizes the rightful priority given to local residents, it is likely that whoever puts the highest bid is a capitalist from the city or a different locale.

The foregoing discussion shows how particular provisions of the Fisheries Code lead to some confusion. The enforcement of laws in municipal waters is reserved only for municipal and city LGUs (Rule 16.9 of DA-Administrative Order No. 3, Series of 1998) as well as enforcement agencies of the government (Section 124). Under Section 65 (m) of RA 8550, BFAR which has been reconstituted into a line bureau, and which is the agency most conversant on fishery laws and regulations, is prohibited from enforcing the law inside municipal waters where violations are most prevalent.

The last paragraph of Section 16, RA No. 8550 on the jurisdiction of the municipal/city governments providing for the management of contiguous fishery resources straddling a number of LGUs irrespective of political subdivisions of municipal waters would pose a problem on the issue of proper jurisdiction. Management would include both enforcement and prosecution until conviction is secured. Questions of jurisdiction occur when the apprehension is done in one municipality but the filing is done in another, as would be the understanding of an enforcer in a "joint fishery management area," leading to immediate dismissal of charges.

Section 97 on the conservation of rare, threatened and endangered species is weak in the sense that what is punishable is only the act of fishing or taking thereof which presupposes that the venue of the offense is in the fishing grounds but not the possession thereof which could be elsewhere like in the markets and ports of call to make it more effective. The shortcomings of this section is amply supported by RA 9147 (An Act Providing for the Conservation and Protection of Wildlife Resources and their Habitats, Appropriating Funds Thereto and for Other Purposes), which punishes the following acts:

1. killing and destroying wildlife species (with exceptions);
2. inflicting injury which cripples and/or impairs the reproductive system of wildlife;
3. committing the following acts in critical habitat(s), including dumping of waste products, squatting, mineral exploration, burning, logging and quarrying;
4. introduction, reintroduction or restocking of wildlife resources;
5. trading of wildlife;
6. collecting, hunting or possessing wildlife, their by-products and derivatives;
7. gathering or destroying of active nests, nest trees, host plants and the like;
8. maltreating and/or inflicting other injuries not covered elsewhere; and
9. transporting of wildlife.

Thus, the imperfections in the Fisheries Code are duly corrected in this section.

There are sections of the Fisheries Code that were merely copied from its predecessor, PD 704. One of these is Section 27: Persons eligible for commercial fishing boat license, which states that no commercial fishing vessel license shall be issued except to citizens of the Philippines, partnerships or to associations, cooperatives or corporations duly registered in the Philippines at least 60% of the capital stock of which is owned by Filipino citizens. The validity of this provision might be questioned due to different provisions of the 1987 Constitution, as against the 1973 Constitution which was the basis for PD 704, which allows domestic fishing corporations with not more than 40% foreign equity participation to engage in deep-sea or offshore fishing, but only if such domestic corporations could first secure an agreement (meaning contract) with the State through any of the permissible modes of coproduction, joint venture or production-sharing arrangements wherein the best benefits accruing thereat shall redound to Filipino citizens (Article XII, Section 2).

Reference

DENR (Department of Environment and Natural Resources), DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources) and DILG (Department of the Interior and Local Government). 2001. Philippine coastal management guidebook no. 2: Legal and jurisdictional framework for coastal management. Coastal Resource Management Project, DENR, Cebu City, Philippines. 170 p

Poaching in Philippine Marine Waters: Intrusion of Chinese Fishing Vessels in Palawan Waters[1]

ADELINA B. BENAVENTE-VILLENA
Legal Services, Palawan Council for Sustainable Development
Puerto Princesa City, Palawan 5300
Philippines

MICHAEL D. PIDO
Center for Strategic Policy and Governance
Palawan State University
Puerto Princesa City, Palawan 5300
Philippines

The Poaching Problem

One of the crucial issues identified for Philippine fisheries is the underutilization of its exclusive economic zone (EEZ) (FSP-PMO 1991). Both small-scale and commercial fishers have not fully utilized the fishery resources within the EEZ region. Ironically, significant portions of the EEZ are being heavily exploited by poachers from surrounding countries. Geographical intrusions include those by the Taiwanese in the north, Indonesians in the south, and Chinese in the west, including Palawan. Official records indicate 15 fishing intrusions in Region 2 involving 95 foreign fishers from 1998 to 2002 and 46 incidents involving 675 foreign fishers in Palawan from 1995 to 2002 (Benavente-Villena 2003). Majority of these poaching incidents occurred in the last two years.

Poaching is among the least studied problems in Philippine fisheries. This is partly attributed to the linkage of poaching with other illegal activities, such as smuggling and illegal entry. There are also inherent difficulties in patrolling the EEZ due to the archipelagic nature of the country. This issue is national in character and cannot be effectively addressed by the communities or the local authorities alone. There are interesting but undefined linkages among foreign ministry officials, poachers, law enforcement authorities and local leaders. Poaching has several, yet unquantified, negative impacts. One is in terms of lost catch and/or revenues. Marine resources that could have been harvested by our municipal and commercial fishers are taken instead by foreign fishers. Another impact is environmental in nature, such as habitat degradation, through the use of destructive fishing gears and noxious substances.

Aside from poaching, these foreign fishers have been violating other Philippine laws. In Region 2, where majority of poachers are Taiwanese (61%), followed by Chinese (26%) and Indonesians (13%), the Regional Committee on Illegal Entrants (RCIE 2003) has filed criminal charges not only for poaching but for violating various sections of Republic Act (RA) No. 8550 (Fisheries Code) as well as other laws, such as the Revised Penal Code for falsification of public documents.

There are sufficient laws concerning poaching. The entry of foreign nationals with intent to fish within Philippine waters is largely an issue of enforcement and prosecution rather than that of legislation. Notwithstanding, an amendment to the penalty provisions of the Fisheries Code of 1998 could give more teeth and substance to the present legislation on poaching.

Philippine Policy on Poaching

The policies on poaching may be classified into three: (1) constitutional mandate, (2) national laws and (3) executive issuances. Article XII of the 1987 Philippine Constitution stipulates that the state shall protect the

[1] This paper can be cited as follows: BENAVENTE-VILLENA, A.B. and M.D. PIDO. 2004. Poaching in Philippine marine waters: Intrusion of Chinese fishing vessels in Palawan waters, p. 265-268. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

nation's marine wealth in its archipelagic waters, territorial sea and economic zone. Further, the Constitution reserves the use and enjoyment of such marine resources exclusively to Filipino citizens. Section 7 of Article XIII provides that the state's protection shall extend to offshore fishing grounds of subsistence fishers against foreign intrusion.

The main national law dealing with poaching is the Fisheries Code of 1998. Section 3 states that the provisions of the code shall be enforced in all Philippine waters and the country's EEZ and continental shelf. The Philippine EEZ was not established until PD 1599 in 1978. Section 1 of PD 1599 established the EEZ extending 200 nautical miles (approximately 360 km) from the baselines of the territorial sea. Within the EEZ, the Philippines asserts sovereign rights for purposes of exploration, conservation, utilization and exploitation of living and nonliving resources of the seabed.

As the main controlling law, RA 8550 largely codifies most of the previous fisheries laws. Poaching is discussed under Section 87. It states that:

> ...it is unlawful for any foreign person, corporation or entity to fish or operate any fishing vessel in Philippine waters. The entry of any foreign fishing vessel in Philippine waters shall constitute a prima facie evidence that the vessel is engaged in fishing within the territorial waters. Violation of the above shall be punished by a fine of one hundred thousand US dollars (US$100,000.00) in addition to the confiscation of its catch, fishing equipment and fishing vessel; provided that the Department is also empowered to impose an administrative fine of not less than US$50,000.00 but not more than US$200,000.00 or its equivalent in Philippine currency.

Fisheries Administrative Order No. 200 provides the guidelines and procedures for implementation of this particular section of the Fisheries Code. As such, poaching is operationally defined as "fishing or operating a fishing vessel, committed by a foreign person, entity or corporation; but does not include foreigners engaged in leisure or game fishing. Prima facie presumption arises when vessel enters Philippine waters under certain conditions." These include: fishing gear deployed or not stowed; navigating in irregular track or route; no prior notice to, or clearance from proper authority; navigating in a manner that does not qualify as innocent passage; being outside traditional navigation routes; being in identified fishing grounds; and not flying its national flag.

As an institutional response, the National Committee on Illegal Entrants (NCIE) was created by Executive Order (EO) 656 (1981). It was re-organized by EO 236 (1995) with a 13-member interagency committee. The Department of Foreign Affairs acts as chair with the Department of Justice, Department of National Defense and Department of the Interior and Local Government serving as vice chairs. The poaching situation was accentuated with the foreign intrusion into Mischief Reef and Scarborough Shoal in the South China Sea. Hence, the need to protect Philippine waters from increasing incidents of foreign intrusions became more critical. Guidelines for arrest of illegal entrants and their vessels are originally contained in NCIE Resolution 01-02.

Palawan Case Study

There are no expressed local legislations dealing with poaching in Palawan waters. However, the Provincial Government through its *Sangguniang Panlalawigan* (Provincial Council) has passed several resolutions expressing its full support for the prosecution of poachers to the full extent of the law. In February 2002, when some 95 Chinese poachers were apprehended in the vicinity of Tubbataha Reef National Marine Park and World Heritage Site, the *Sangguniang Panlalawigan* passed Resolution No. 4954, entitled "A resolution strongly urging the prosecution, to the full extent of the law, of the Chinese fishermen recently apprehended poaching within Philippine waters".

A similar resolution was adopted by the Palawan Council for Sustainable Development (PCSD), a local-based council created under RA No. 7611, expressing concern for the continued intrusion of foreign fishing vessels in blatant disregard of Philippine laws. The PCSD was the main complainant in criminal cases filed against the poachers for violation of various provisions of RA 8550. Joining PCSD as co-complainants were the Bureau of Fisheries and Aquatic Resources (BFAR), the local government of Cagayancillo, the Philippine National Police and the Philippine Navy. The PCSD Legal Committee was re-activated to serve as the legal arm of the council in the prosecution of poaching cases and other violations of environmental laws, rules and regulations. When the poachers were convicted, the *Sangguniang Panlalawigan* passed Resolution No. 5253, urging concerned agencies to collect fines imposed by the court.

A systematic attempt to record poaching cases in the province came only when NCIE was re-organized in 1995 by EO No. 236. Immigration data from the Provincial Immigration Office, however, would show that intrusion of foreign nationals in Palawan waters was noted even in the early 1970s. Over the eight-year period (1995 to 2002), foreign intrusion reached

46 incidents involving 675 persons, majority of whom are Chinese (70%) (see Table 1).

On a yearly basis, the figures from 1995 to 2002 (Table 2) portray a sharp increase in poaching over the last two years. An interesting fact is that two of the Chinese fishing vessels and some of the crew have been apprehended several times within the last two years. The provincial jail warden attests that some of the detainees were, in fact, second timers. The most exploited areas are those in the southern and western parts of Palawan. In recent years, however, the northwest and eastern sides have likewise been intruded. This makes the municipal waters, as well as the marine protected areas, vulnerable to exploitation by foreign nationals.

Table 1. Foreign intrusion in Palawan by nationality, 1995–2002 (PCSDS/PCIE/WESCOM 2002).

Nationality	Number	%
Chinese	469	70
Malaysian	121	18
Vietnamese	49	7
Indonesian	26	4
Taiwanese	10	1
Total	675	100

In terms of geographic distribution, records show that about 37% (17) of 46 intrusions were apprehended within the territorial jurisdiction of the municipality of Balabac (Figure 1), followed by 17% (8) in the vicinity of the Kalayaan Island Group; 15% (7) in the Quezon-Rizal areas; 15% (7) in Cagayancillo and Tubbataha areas; 4% (2) in the Malampaya Natural Gas Project and 11% (5) in the eastern side of the province.

In the case of the 95 Chinese fishers, they were caught in the act of fishing when apprehended within the territorial jurisdiction of the Tubbataha National Marine Park. The apprehending officers witnessed the crew members actually throwing overboard an undetermined number of marine turtles and other evidence when they were about to be apprehended. Other pieces of evidence include endangered species of marine flora and fauna, such as fan coral and giant clams (*Tridacna* sp.). Some 30 sacks of dried meat of giant clams, 4 sacks of dried sea cucumber and 13 pieces of live wrasses were confiscated, together with noxious substances, such as sodium cyanide. There were also blasting caps and detonating cords that are prima facie evidence of the use of explosives.

Three months later, the local fisherfolks headed by their municipal mayor apprehended 20 Chinese fishers in the act of fishing within the municipal waters of Cagayancillo. In the course of the apprehension, the fishing vessel ran aground damaging some 40 m^2 of coral reef areas (Sebastian 2002). Various species of live wrasses and grouper estimated to be more than 600 kg (in sizes ranging from 20 cm to 145 cm) were confiscated, together with more than 30 bottles and 3 containers (5-gallon capacity) of solution and 35 tablets of sodium cyanide. Samples of solution taken from bottles and containers were tested at the BFAR Cyanide Detection Test Laboratory in Puerto Princesa City and were found positive for sodium cyanide.

Months later, a research team that visited Tubbataha found at the south atoll of the reef some 1,500 m of fishing net that has trapped and killed 124 marine turtles and a shark. The net was compared to the confiscated fishing net from the Chinese poachers and was found to be identical.

Conclusion

The recurring presence and continuous foreign intrusions in Philippine waters, despite apprehensions and confiscation of catch, is proof that foreign fishers utterly disregard Philippine laws. Such attitude on the part of the poachers indicate two things. First, the potential revenues earned from poaching in Philippine national waters far outweigh the constant threat of apprehension. Second, this situation also reflects the weaknesses in the prosecution of cases that has emboldened the poachers to continuously violate national integrity. The extent of poaching at the national level in general, and in Palawan in particular,

Table 2. Entry of foreign nationals by year and by nationality, 1995-2002.

Year	Chinese	Malaysian	Vietnamese	Indonesian	Taiwanese	Total
1995	76		10	2		88
1996		52		19 (incl. 2 Filipinos)		71
1997	23					23
1998	46					46
1999	35	60	18	5	3	121
2000	7	9	12		7	35
2001	108		9			117
2002	174					174
Total	469	121	49	26	10	675

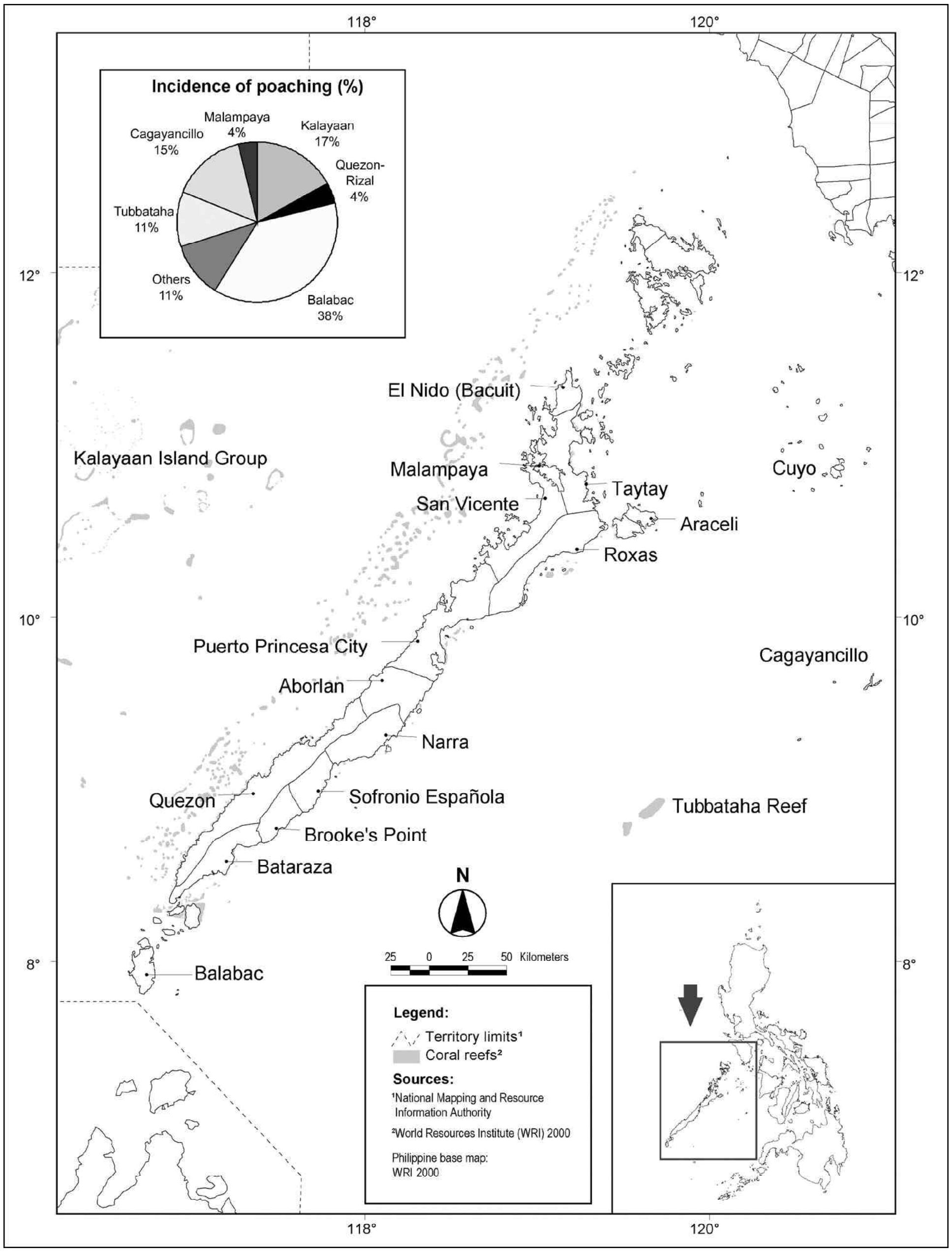


Figure 1. Distribution of poaching incidents in Palawan waters.

necessitates that this issue be given more emphasis. The entry of foreign fishing vessels has led to the destruction of coral reefs and associated marine habitats. The dollar equivalent of illegally harvested fishery resources need to be assessed accurately. There is also a need to look into poaching as both enforcement and prosecution issues.

References

Benavente-Villena, A.B. 2003. The plunder of Palawan's coastal treasures. Paper presented at the Second National Training on Poaching in Philippine Waters. Dapitan City, Philippines.

FSP-PMO (Fisheries Sector Program-Program Management Office). 1991. Fisheries Sector Program. Department of Agriculture, Quezon City, Philippines.

PCSDS/PCIE/WESCOM (Palawan Council on Sustainable Development/Philippine Committee on Illegal Entrants/Western Command). 2002. Foreign intrusion in Palawan. Unpublished records prepared by the PCIE Secretariat.

RCIE (Regional Committee on Illegal Entrants). 2003. Case of illegal entrants in Cagayan and Batanes. National Committee on Illegal Entrants Meeting, 22 April 2003, Makati City, Philippines.

Sebastian, C.A. 2002. Foreign fishing vessel apprehension. BFAR Regional Office No. 2, Tuguegarao City, Philippines.

Regional Fisheries Management Planning: A Work in Progress[1]

JOEZEN Q. DIZON- CORRALES
Coastal Resources Management Section
Department of Agriculture - Bureau of Fisheries and Aquatic Resources -VII
Arellano Blvd., Cebu City
Philippines

Introduction

As the government agency responsible for managing the country's fishery and aquatic resources, the Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture is charged with ensuring that those resources are developed, managed and conserved in a manner which is consistent with the principles of ecological sustainability and social equity.

The enactment of the Philippine Fisheries Code of 1998 presented the bureau with great challenges and opportunities to promote the conservation and sustainable development of fisheries resources while simultaneously achieving food security and socioeconomic upliftment of subsistence fishers. BFAR regional offices have responded with various programs on fisheries management, conservation, research and development, training, extension and policy review. Despite these efforts, however, problems on overfishing and conflicts among the different fishery sectors persist. Hence, there is an imperative need for concerted strategies that focus on sustaining fish stocks and resolving these problems and conflicts. To be operational, such strategies should be outlined in a fisheries management plan.

The Challenge of Planning for a Region with Several Ecosystems

Since the enactment of the Local Government Code of 1991 (Republic Act 7160), the responsibility for the management of coastal resources has been devolved to coastal municipalities. While the devolution of management responsibility and authority to coastal municipalities is most welcome, there has been a tendency for coastal municipalities to be exclusively concerned with fisheries within their municipal waters. Fish, however, move around, spawn and breed over large geographical areas.

Ideally, an ecosystem perspective should guide fisheries management. This requires, among other things, that the boundaries of the planning area coincide with those of an ecosystem. Using the ecosystem as a unit for fisheries management planning at the regional level would not be too difficult in regions that have few embayments or other waters that may be treated as single ecosystems. For example, most waters of Region XI are within the Davao Gulf, which may be treated as an ecosystem and which may be the focus of fisheries management. In contrast, Region VII or the Central Visayas region contains a variety of ecosystems and geographically isolated fishing areas, such as the part of the Visayan Sea, Camotes Sea, Mindanao Sea, Eastern Sulu Sea, Cebu and Tañon Strait all under its jurisdiction (Figure 1). Nevertheless, BFAR-Region VII is embarking on a fisheries management planning exercise to cover the whole of Central Visayas region.

By looking from a regional perspective, the coastal habitats and fisheries resources can be identified, and extra resources can be allocated towards protecting the more critical of these resources or areas. Given the variety of fisheries management related activities and agencies involved in coastal management in the region, it is important to consolidate these and provide a clear, overall direction. The planning process (Figure 2) will involve a series of consultations and the development of a fisheries profile of the area that looks

[1] This paper can be cited as follows: DIZON-CORRALES, J.Q. 2004. Regional fisheries management planning: A work in progress, p. 269-272. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

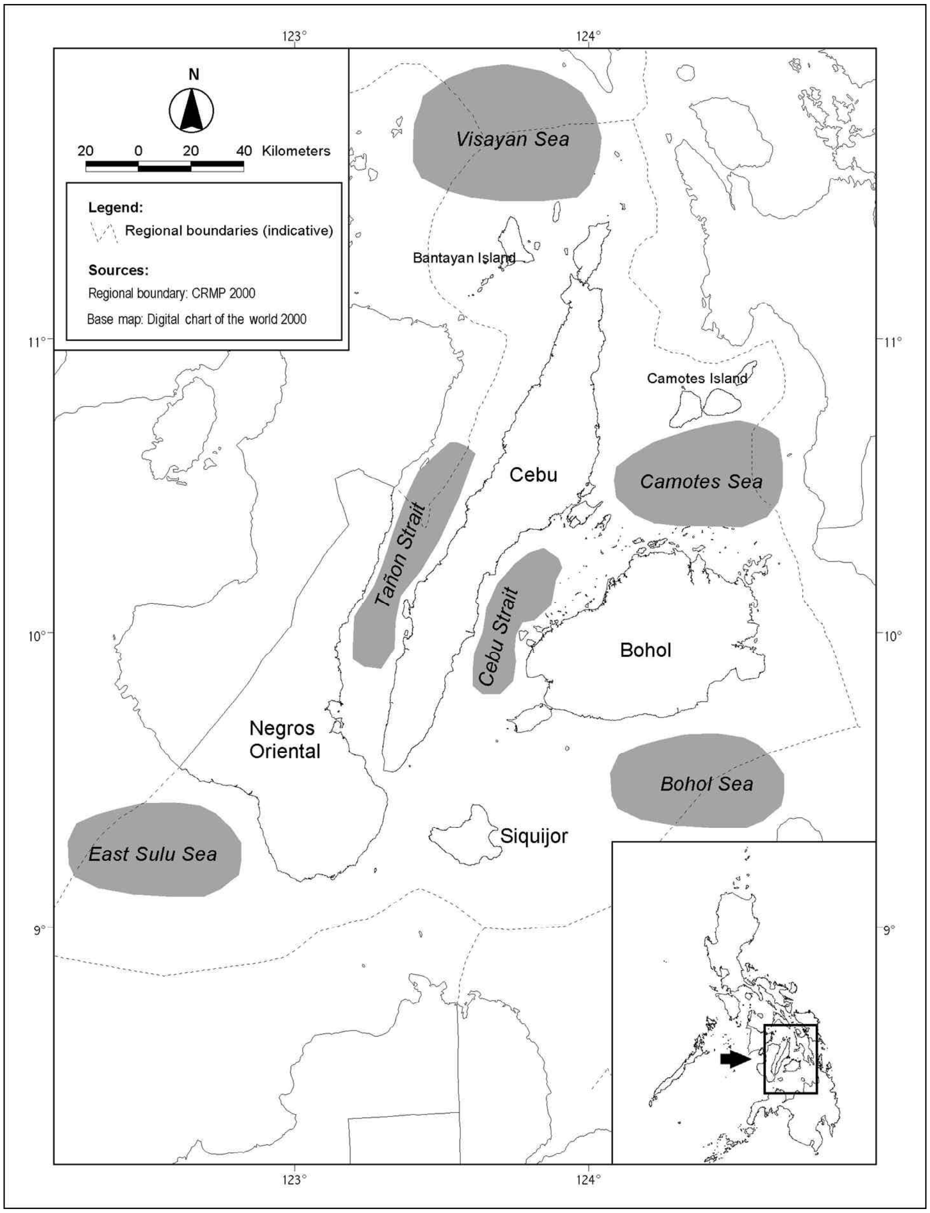


Figure 1. A map showing the different areas in the Central Visayas region that may be regarded as distinct ecosystems. This presents a challenge to fisheries management planning that intends to adopt an ecosystems approach.

at the needs of each province. The aim of these activities is to encourage BFAR and other agencies to streamline and focus their efforts on priority issues and problems within the region.

Levels of Issues

Given that on the whole the fisheries resources of the region are still in an "open access" regime, it is also important to identify three major sets of issues.

- Intraprovincial issues: Those issues that are within a province and its composite municipalities and can be resolved internally within the province, e.g., illegal fishing gears, harvesting of juveniles in certain seasons, etc.
- Interprovincial issues: Those issues that are between provinces from within the same region, with fishers coming in from other areas from within the region, e.g., supplies of dynamite blasting materials, cyanide and placing of fish aggregating devices by outsiders into municipal waters.
- Interregional (national) issues: Those issues that are difficult to manage through regional mechanisms because these are caused by factors or fishers coming from outside the region, e.g., commercial fishing boats from outside the region entering the

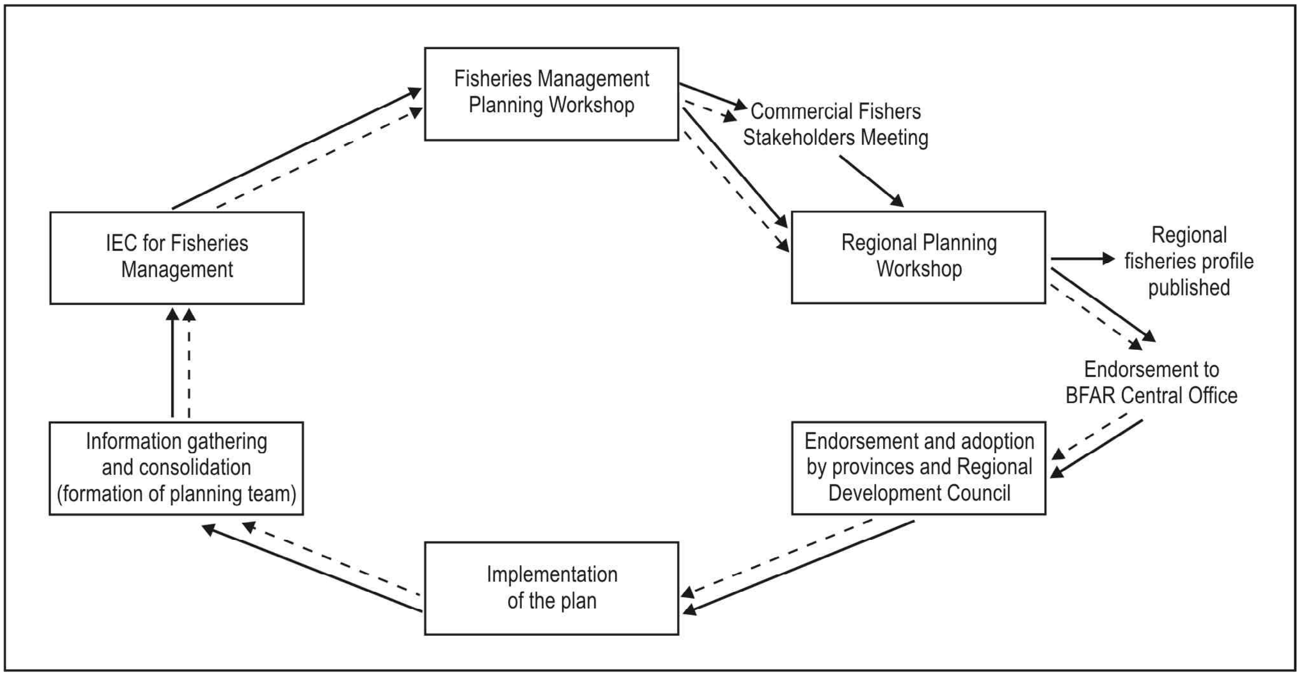


Figure 2. Diagram illustrating the planning process in Region VII.

region's waters during spawning and peak fishing seasons.

Goals and Objectives

The following are the goals and objectives of the regional fisheries management planning initiative:

- Consolidate the results of the various initiatives ongoing in Region VII and initiated by national government agencies, nongovernment organizations, provincial and municipal governments into a regional fisheries profile.
- Encourage local government units (LGUs) and other agencies to look at the region's fisheries in a more holistic manner.
- Conduct a series of consultations on fisheries management awareness with the provincial governments and key stakeholders to develop provincial fishery plans and consolidate these into a regional plan.
- Document the process for possible replication by other BFAR regional offices in and around the country.
- Research possible incentives for the provincial and municipal governments to develop inter-LGU relationships and to refocus BFAR efforts on fisheries management for the whole of the region.
- Illustrate that some systems such as commercial fishing will be impossible to manage unless an incentive or limited access regime is developed for commercial fishers from the regions where they are licensed.

Management Concepts for the Regional Fisheries Management Plan

The value of a fisheries management plan is gaining recognition throughout the world. Such a plan describes the management of a particular fishery and documents important information relevant to the fishery (Pollock 1996). There are three management-guiding themes that will be followed to ensure that the fisheries management plan achieves its objectives.

- Principle 1: Fisheries in Region VII must be conducted in a manner that does not lead to overfishing. For those stocks that are overfished, the fishery must be conducted such that there is a high degree of probability that the stocks will recover. To do this, we need to:
  - establish fisheries information management systems;
  - conduct stock assessment research regularly; and
  - implement management strategies to control the level of fishing effort.
- Principle 2: Fishing operations should be managed to minimize their impact on the structure and function as well as biological diversity of the ecosystem. Again, there is a need to:

  - establish information management systems on marine ecosystems and the fisheries activities that affect them;
  - assess major issues and their implications; and
  - implement management actions that will ensure the integrity of ecosystems.
- Principle 3: Implement a strategic zoning of the region's waters, identifying key areas and defining different manageable zones.

Conclusion

The regional fisheries management plan being developed will be the first of its kind in the country. If successful, other BFAR regional offices could replicate the planning process in their regions. The process could set a framework for BFAR offices and LGUs to better collaborate in an ecosystem approach given the complexity of their geopolitical boundaries.

Reference

Pollock, B. 1996.Fisheries management in the Philippines: A brief review. *In* Main report of the Second National Fisheries Workshop on Policy Planning and Industry Development. Vol. 2. Department of Agriculture-Bureau of Fisheries and Aquatic Resources and Food and Agriculture Organization, Quezon City, Philippines.

Integration of Fisheries into Coastal Area Management[1]

RUDOLF HERMES
Visayan Sea Coastal Resources and Fisheries Management Project
Bureau of Fisheries and Aquatic Resources-
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
Iloilo City 5000
Philippines

Introduction

This topic is one of the six thematic articles of the Code of Conduct for Responsible Fisheries (CCRF) (Figure 1) issued by the Food and Agriculture Organization (FAO 1995) which is based on a framework developed during the International Conference on Responsible Fishing in Cancun, Mexico, in May 1992, further refined during sessions of the FAO Committee on Fisheries, and adopted in 1995.

It is of particular importance to the Philippines, considering the fragile state of coastal ecosystems, the needs of coastal communities, and the fact that most marine fisheries are based on coastal stocks or exploit offshore stocks, which spend part of their lives in inshore waters. Activities that result in coastal environmental change can have major impacts on the coastal fisheries sector, and the fisheries sector can also affect other coastal activities, e.g. through competition for space. The development and management of the fisheries sector must therefore be considered within the existing context of coastal area management (CAM) and development planning, taking into account the conservation of resources and environment as well as the economic activities within the coastal area (FAO 1996; Scialabba 1998). Given the intensive competition between resource users and uses in the coastal area, there is a clear need for integration, resulting in a shift from resource-use maximization in one sector to resource-use optimization and balancing between sectors.

The Four Dimensions of Article 10 of the Code of Conduct

Institutional framework

Article 10.1 of FAO CCRF calls for the adoption of an appropriate policy, legal and institutional framework to achieve sustainable and integrated use of coastal resources. The Philippine Agenda 21 can be considered a suitable starting point or policy framework. The legal framework is still oriented more towards sectoral concerns, even though the Fisheries Code of 1998 (Republic Act 8550) is already influenced by CCRF. The institutional framework is not yet established[2], and instruments for valuation and resource allocation still need to be developed, or where available, applied. The guidelines for CCRF (FAO 1996) advocate for a holistic approach and an analysis of roles and responsibilities of agencies leading to appropriate coordinating and integrating arrangements to ensure coherence in policy implementation. The need for consulting representatives of the fisheries sector and fishing communities in the decisionmaking process and their involvement in other activities related to CAM planning and development is underlined. In the Philippines, through the creation of Fisheries and Aquatic Resource Management Councils (FARMCs), the necessary conditions for participation have been

[1] This paper can be cited as follows: HERMES, R. 2004. Integration of fisheries into coastal area management, p. 273-276. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] The United States Agency for International Development-funded Coastal Resource Management Project of the Department of Environment and Natural Resources initiated the drafting of a National Coastal and Marine Management Strategy which can be used as a framework for coastal management in the Philippines. The draft document is currently being reviewed by a group of experts with funding from the United Nations Development Programme.

Figure 1. FAO has produced a series of technical guidelines for responsible fisheries.

created (Guerrero 2002). Further work is required to strengthen and institutionalize these FARMCs. Coastal pollution, habitat degradation and spatial or resource conflict are areas of concern where observations and feedback from fishers are most needed, but also most significant. In addition, FARMCs should play a major role in the planning and formulation of policies and programs for management, conservation, protection and sustainable development of fisheries and aquatic resources.

While FARMCs are an instrument for fisherfolk participation, the National Agricultural and Fisheries Council (NAFC), through its Committee on Fisheries and Aquaculture, ensures private sector participation in policy evaluation and formulation. Like FARMC, NAFC has regional, provincial and municipal levels. However, unlike FARMC, NAFC and its local chapters are fully funded by the Department of Agriculture. Thus, some FARMC representatives perceive this to be a disadvantage to activities organized by them, if they manage to source funds at all.

Conflicts arising from competition of different resource uses need to be dealt with through resource allocation mechanisms and mediation, including adoption of fishing practices that prevent or avoid conflict among fisheries users and between them and other users. Zoning is a common approach in the resolution of intersectoral conflicts involving fisheries, given the multiple uses of coastal areas. Comprehensive land use plans are probably in existence in most municipalities. However, up to now, only a minority of coastal municipalities has drafted coastal zoning plans and is implementing these. Aside from mandatory fisherfolk registration, FARMCs and appropriate institutions within the local government units should address this area of concern. The governance, including limitation of access, should follow determination of possible, compatible and sustainable uses.

There is a need for alignment between coastal environmental or fishery management plans and economic / development plans. In the Philippines, there is a hierarchy of plans from local government units (e.g., barangay, municipal and provincial development plans) to regional development and national plans. The integration of fisheries in CAM can best be achieved so far on the level of local government units. It should be an aim of planners to integrate further on the regional level, i.e., not to focus foremost on sectoral concerns on the level of the Regional Development Council. On the other hand, these concerns should also not be dealt with by the sectoral line agency, the Bureau of Fisheries and Aquatic Resources, alone, and if so, a major change in mandate is possibly required. A CAM plan, which attempted to integrate fisheries, was drafted for the Lingayen Gulf in northern Luzon through the Association of Southeast Asian Nations (ASEAN)-United States Coastal Resources Management Project (Chua and Scura 1992). Recommendations regarding fisheries (e.g., on optimum effort) were not fully implemented, however.

Policy measures

In order to translate recommendations into action, there is still the need to create more public awareness of the necessity for protection and management of coastal resources and participation in the management process by those affected (Article 10.2, CCRF, FAO 1996). Increased awareness and participation will help ensure that the interests of stakeholders are properly represented, but consequently reduce the risk of errors and alienation and increase compliance. The formation of FARMCs is a step in the right direction, as well as the relatively active role of nongovernment organizations (NGO) in the Philippines and ample media exposure. The strengthening of fisherfolk or peoples' organizations is another way, taking into account the time-consuming and demanding nature of the fisheries profession. However, the development of information materials and proper dissemination on the need to integrate fisheries into CAM in particular, and CCRF in general, is still very much required.

An inherent difficulty in decisionmaking on allocation of coastal resources is the uncertainty in valuation, taking into account economic, social and cultural factors, as well as both market and nonmarket values. Given the highly degraded and overfished nature of Philippine fish stocks, valuation techniques should probably include lost economic opportunities, having in mind potential harvests from reconstructed fish stocks. This process consists of two steps. First, select valuation techniques (e.g., Pomeroy 1992) and conduct good valuation studies. This step has already been accomplished with various reports estimating "opportunity costs" or "losses to fishing" in both demersal and pelagic fisheries (Silvestre and Pauly 1989; Trinidad *et al.* 1993). The second step appears to be more elusive and difficult to handle: translating the scientific findings into palatable decisionmaking tools and actually applying or enforcing the resulting recommendations.

So much damage has already occurred to Philippine coastal resources; nevertheless, it is important to consider pre-emptive action to protect the fisheries sector from further damage. In order to reduce risks and uncertainties, it is also necessary to promote the establishment of systems to monitor the coastal environment, as part of the process, using physical, chemical, biological, economic and social parameters. Environmental degradation from all sources should be identified early on, with the policy objective of prevention, rather than cleanup or reconstruction. Institutional strengthening at all levels (national government, private sector and universities) is still required, as is capacity development in the application of necessary tools (e.g., geographic information systems or GIS). Multidisciplinary research efforts should be directed towards the interaction of environmental and economic systems in support of CAM. Promotion of communication between fisheries policymakers and scientists will ensure that research institutions address the key issues in proper integration of fisheries in CAM and planning.

Regional cooperation

Regional cooperation between states with neighboring coastal areas to facilitate sustainable use of coastal resources and conservation of the environment is the concern of Article 10.3 of CCRF (FAO 1996). This article calls not only for the consultation and timely information in the case of activities that may have an adverse transboundary environmental effect on coastal areas, but also for subregional and regional level cooperation in order to improve CAM. The Philippines has embarked on a process of concluding fisheries agreements with neighboring states (e.g., Indonesia), and also promotes the sharing of coastal management training and implementation expertise through various contacts on government, NGO and academe levels. Examples are the integrated coastal management training links with Vietnam and Indonesia through the Department of Science and Technology-Philippine Council for Aquatic and Marine Research and Development, and the trinational initiative, Sulu-Sulawesi Marine Ecoregion Programme, spearheaded by the World Wide Fund for Nature jointly with Malaysia and Indonesia. Within the Department of Foreign Affairs, regional linkages are coordinated through the Maritime and Ocean Affairs Committee. Other channels of cooperation that could possibly be strengthened further are the respective ASEAN ministerial level processes (e.g., Committee on Science and Technology, Education, Agriculture and Fisheries). The Philippines has actively participated in ASEAN CAM programs (Guerrero 2002).

Implementation

Successful implementation of coastal area development, planning and management depends on appropriate mechanisms for cooperation and coordination among agencies involved (Article 10.4, CCRF, FAO 1996). Passing on externalities generated by one sector to another is often a result of conventional sector planning. More attention, therefore, needs to be given to cross-sectoral impacts and effects of management interventions. This will usually involve a negotiation process of trade-offs between development proposals. Providing a forum for the resolution of conflicting sector-based actual and proposed actions is therefore a requirement. At present, the Regional Development Councils have to fulfill this role but may also require further strengthening. As earlier mentioned, the National FARMC has been created as a body to assist in the formulation of national fisheries policies.

Finally, the FAO guidelines for CCRF also call for adequate technical capacities and financial resources for authority or authorities representing fisheries in the coastal management process. In terms of human resource requirements, this refers to the need of trained generalists and specialists to staff any core group which might be established to coordinate intersectoral programs and policies. For fisheries authorities in particular, CCRF calls for the development of strengths in four main areas: (1) skills and experience in collection and analysis of biophysical, social and economic information, and its use in policy analysis; (2) establishment of institutional arrangements at local, national, subregional and regional levels to deal with open access issues and cross-sectoral impacts; (3) skills and experience in sectoral planning; and (4) enforcement capacity. It can be argued that this call for capacity-building also applies to the Philippine setting.

Aside from the needed capacity-building, there is also still much to be done regarding establishment and strengthening of a framework which is appropriate for integration of fisheries in CAM. While policy measures may have already been worked out, their implementation and compliance are still lacking. There is, however, already some encouraging success in the area of regional cooperation, in particular, in view of training and research or assessments.

Bibliography

Chua, T.E. and L.F. Scura, Editors. 1992. Integrative framework and methods for coastal area management. ICLARM Conf. Proc. 37, 169 p.

DENR (Department of Environment and Natural Resources). n.d. Proposed integrated coastal management policy for the Philippines. DENR, Philippines.

FAO (Food and Agriculture Organization). 1995. Code of Conduct for Responsible Fisheries. FAO, Rome, Italy. 41 p.

FAO (Food and Agriculture Organization). 1996. Integration of fisheries into coastal area management. FAO Technical Guidelines for Responsible Fisheries No. 3. FAO, Rome, Italy. 17 p.

Guerrero, R.D. III. 2002. The implementation of the FAO Code of Conduct for Responsible Fisheries and related international programs of action in the Philippines. Philippine Council for Aquatic and Marine Research and Development, Laguna, Philippines. 20 p.

Pomeroy, R.S. 1992. Economic valuation: Available methods, p. 149-162. In T.E. Chua and L.F. Scura (eds.) Integrative framework and methods for coastal area management. ICLARM Conf. Proc. 37, 169 p.

Scialabba, N., Editor. 1998. Integrated coastal area management and agriculture, forestry and fisheries. FAO Guidelines. Environment and Natural Resources Services, FAO, Rome, Italy. 256 p.

Silvestre, G. and D. Pauly. 1989. Estimates of yield and economic rent from Philippine demersal stocks (1946-1984) using vessel horsepower as an index of fishing effort. Univ. Philipp. Vis. Fish. J. 1(2); 2 (1/2); 3 (1/2): 11-24.

Trinidad, A.C., R.S. Pomeroy, P.V. Corpuz and M. Aguero. 1993. Bioeconomics of the Philippine small pelagics fishery. ICLARM Tech. Rep. 38, 74 p.

An Overview of Capture Fisheries Management in the Context of Integrated Coastal Management[1]

MICHAEL D. PIDO
Center for Strategic Policy and Governance
Palawan State University
Puerto Princesa City, Palawan 5300
Philippines

Values and Threats in Coasts

The values of the coastal zone - the dynamic interface between land and sea – cannot be overstated (Sorensen *et al.* 1984). The coastal region provides the natural resource base for economic development, such as manufacturing industry, maritime trade, energy, fisheries, agriculture and tourism. Many livelihoods depend on use of coastal resources, with more than 50% of the world's population inhabiting this geographical strip. For tourism and fisheries uses of healthy coral reef areas, as example, the estimated annual economic net benefit per square kilometer ranges from US$23,100 to US$270,000 (Burke *et al.* 2002). The services and protective functions provided by the coasts are estimated to be more valuable than their intrinsic resources and may be worth "about US$23 trillion a year, only slightly less than the world's GNP" (GESAMP 2001). In Southeast Asia alone, close to 266 million people live within 60 km of the coast (ICLARM 1999) and 16 million people are directly involved in small-scale fisheries (Menasveta 1998).

Despite the vital contributions of coastal ecosystems, they have seldom been managed appropriately. Worldwide, the key problems confronting the coastal zone are: (1) habitat degradation, (2) nonoptimal use of resources and (3) pollution. Human activities in the coasts that continue to destroy vital habitats include runoff from improper agriculture and forestry practices, modification of riverine flows through construction of infrastructure projects, destruction of mangrove forests for aquaculture, indiscriminate reclamation for settlements and destructive fishing methods (Chou *et al.* 1994; Rawlings *et al.* 1998; Talaue-McManus 2000).

Inefficient use of resources is perhaps most apparent in the case of fisheries where overfishing has led to dramatic declines in coastal fish stocks, particularly in South Asia and Southeast Asia (Hotta 1996; Silvestre and Pauly 1997). Globally, the quality of coastal waters continues to decline, mainly due to discharge of land-based pollutants (Gabric and Bell 1994; Goldberg 1995; Chia and Kirkman 2000). Sewage pollution, for instance, has massive effects on human health. These three key problems impinging on the coastal zone often act in concert. Their combined assaults have reduced productivity resulting in loss of livelihood options, poverty and poor health of the coastal people.

The Need for Integrated Coastal Management

The complex problems facing the coastal zone were recognized during the 1970s (Cicin-Sain and Knecht 1998) and since then, many initiatives were used to address them at various levels. The Land-Ocean Interactions in the Coastal Zone (http://www.nioz.nl/loicz/welcome.html), for instance, represents a worldwide project with regional and national representation. The Global Environment Facility (GEF)/United Nations Development Programme/International Maritime Organization Regional Programme on Partnerships in Environmental Management for the Seas of East Asia (http://www.pemsea.org/) and the United Nations Environment Programme (UNEP)/GEF South China Sea Project (http://www.unep.ch/seas/rshome.html) are regional initiatives. The Coastal Resource Management Project in the Philippines (http://www.usaid-ph.gov/crm.html;http:www.oneocean.org) and Indonesia (http://www.crc.uri.edu/field/asia/

[1] This paper can be cited as follows: PIDO, M.D. 2004. An overview of capture fisheries management in the context of integrated coastal management, p. 277-281. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

indonesia/index.html) are examples of national programs. The widespread awareness of the problems now facing the coastal zone is perhaps best illustrated by the action of UNEP in initiating 14 Regional Seas Programs in line with implementation of the United Nations Conference on Environment and Development (UNCED) Agenda 21 and its Chapter 17 on ocean governance.

Despite the many international, regional, national and local level initiatives, many coastal threats remain. It is now also apparent that a "sectoral and disciplinary approach to marine and coastal development does not provide an effective framework for achieving sustainability and resolving conflicts over resource use" (UN 1993). In general, there is weak institutional capacity to identify the multiple problems and provide an integrated solution, particularly at the local level. Among the causes of institutional failure in managing the coasts are: (1) inadequate legal and policy support; (2) lack of technical know-how on the part of managers and political leaders; (3) lack of coordination among sectoral agencies; (4) limited involvement of coastal stakeholders, particularly the private sector and marginalized groups; and (5) dependence of governments in developing countries on external aid (Chua *et al.*1992; Scura *et al.* 1992; Chua 1996, 1998).

Integrated coastal management (ICM) aims to address the limitations of sectoral approaches to coastal governance. ICM may be defined as a "continuous and dynamic process by which decisions are made for the sustainable use, development and protection of coastal and marine areas and resources" (Cicin-Sain and Knetch 1998). In effect, it is a unifying concept to promote ecologically sustainable development in the coasts. In terms of purpose, "the overall goal of ICM is to improve the quality of human communities who depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems" (GESAMP 1996). Integration in ICM covers various dimensions or components. It could be geographical (between land and sea); sectoral (among different economic sectors present); institutional (among different levels of governance, from local to international); temporal (between present and future generations); and policy (between research and management, as well as across disciplines of science).

ICM adheres to some guiding principles. First is intergenerational equity, which means the future generations are also entitled to current benefits derived from the coasts. Second is the precautionary principle espousing that if there is lack of full scientific certainty, either postpone the project or install immediately cost-effective measures to prevent environmental degradation. Third is the polluter pays principle, which indicates that environmental costs of economic activities should be borne by the developer. Fourth is transparency, encouraging that decisions should be made with full public involvement.

ICM associated concepts and terminologies

- Coastal zone management (CZM) was the earliest term used in the US in 1972. This was followed by integrated coastal area management (ICAM) in the developing countries. In the 1990s, the phrases integrated coastal zone management (ICZM) and integrated coastal management (ICM) were used. Recently, the term integrated marine and coastal area management (IMCAM) has become popular.
- ICM shares conceptual and methodological "overlaps" – but is not necessarily synonymous - with terms such as co-management or community-based coastal resources management (CBCRM). Co-management's emphasis is on partnership arrangements among various stakeholders utilizing the resource. CBCRM, on the other hand, is focused on a more defined community of users. Its geographical focus is also limited, such as a small island, or confined to a particular resource ecosystem, like a tract of mangrove or a patch of coral reef.

The major functions of ICM include (Cicin and Knetch 1998):

1. Area planning - aims to map out present and future uses to provide long-term vision and specific courses of actions.
2. Promotion of economic development –includes programs that are appropriate and compatible, such as ecotourism and environment-friendly fishing practices.
3. Stewardship of resources – that users must protect the ecological base of coastal areas and preserve biodiversity.
4. Conflict resolution – aims to harmonize existing and potential uses, as well as to reduce conflicts among competing stakeholders.
5. Protection of public safety – this is protection from both natural and artificial hazards.

The ICM system has two key components: the management framework and the systematic process for preparing, initiating, developing, adopting, implementing, consolidating and refining programs and projects (Chua 1998). ICM does not supplant or replace sectoral management. On the contrary, ICM integrates the needs and efforts of the different sectors to address multiple-use conflicts (Figure 1). The success of ICM is in fact contingent on strong sectoral agencies. In effect, ICM attempts to maximize the positive societal benefits, and at the same time reduce the negative environmental impacts. Cicin-Sain and Knetch (1998)

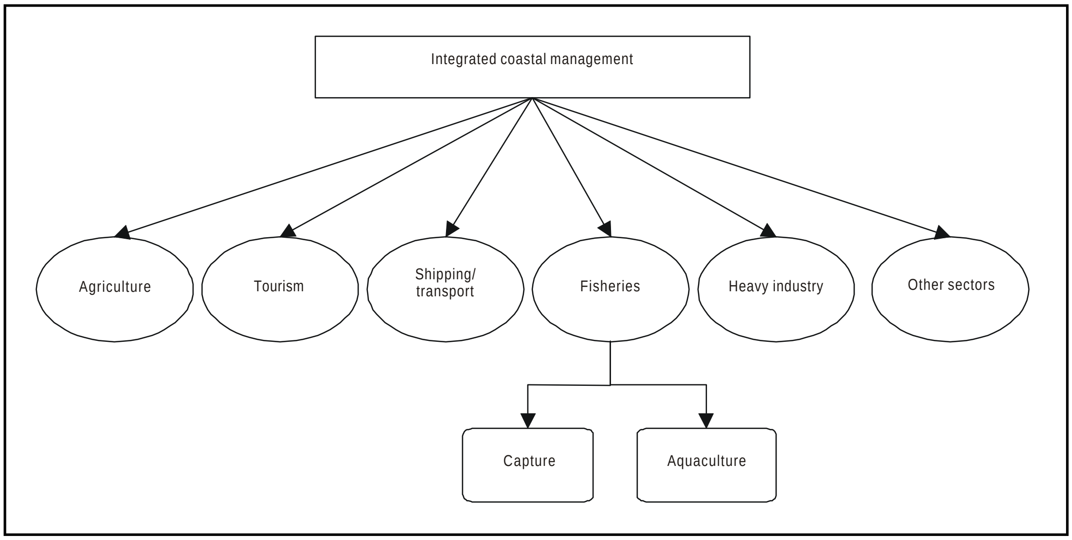


Figure 1. ICM as "over-arching" framework in fisheries management.

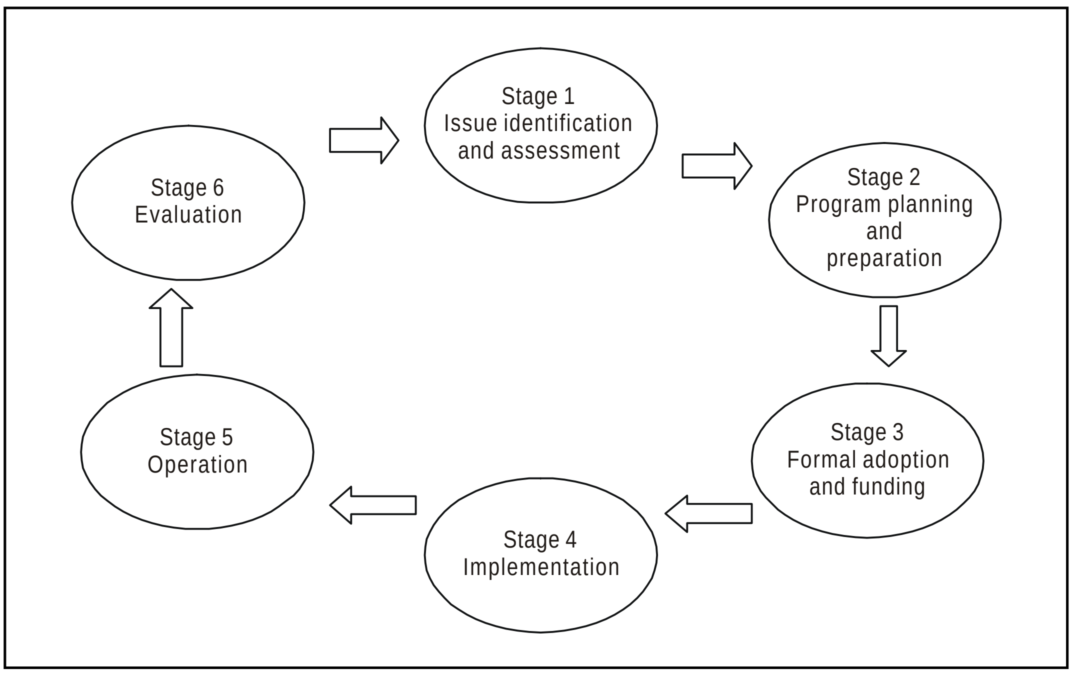


Figure 2. The six stages of an ICM process (Olsen 1993; Cicin-Sain and Knecht 1998).

described a generic, six-stage ICM process from issue identification/assessment to evaluation (Figure 2). Given this process, ICM provides a synergistic effect by coordinating sectoral efforts, enabling such sectoral integration to address multiple-use conflicts and competing priorities. ICM also harmonizes the different roles and needs of national, provincial (or subnational) and local governments. Through ICM, linkages with international organizations and donor agencies are also effectively established. It was endorsed by international bodies like the Intergovernmental Panel on Climate Change and the Intergovernmental Oceanographic Commission, and was adopted by international conventions like UNCED in 1992.

Linking Fisheries Management and Integrated Coastal Management

There is a growing realization on the need for a more comprehensive and integrated approach, such as the ICM framework, to effectively maintain the ecological integrity of coastal areas in general, and to promote the sustainability of coastal fisheries in particular. Fisheries management is the dual process of conservation and allocation (Smith 1988), and therefore, it pursues multiple objectives. Conservation asks "how much" fish stocks are available for sustainable harvesting. Allocation is largely the human dimension, pertaining to the who, when, where and how of fishery management. Fisheries need to be viewed within the broader context of ICM because the full attainment of the above objectives lies outside the fisheries sector. While Philippine fisheries management agencies may effectively deal with the regulation of fishing effort and to some extent enforcement, they cannot adequately address other crucial issues, such as poverty alleviation, limited utilization of exclusive economic zone water and habitat degradation (FSP-PMO 1991). Solutions to these problems are contingent on the performance of other economic sectors. Overfishing, which is partly an outcome of policies for the entire agriculture sector, has resulted in economic loss that in the Philippines alone was estimated at US$150 million per annum (Silvestre and Pauly 1997). Further, fisheries are also impacting on other sectors. The effects of fishing on the environment are among the most serious threats worldwide (GESAMP 2001).

The need for an integrative framework for analyzing the key elements of successful fisheries management is now widely recognized. The dynamics and complexity of capture fisheries requires an integrated management to address several constraints that are outside the domain of the fisheries industry. In Southeast Asia (Chua *et al.* 1992), the trend has been towards ICM. Scura (1993a, 1993b) reviewed the experiences of some international research institutions on ICM, and also developed a typological framework and strategy elements for integrated coastal fisheries management. Chua (1997) argued for the application of an ICM system for sustaining coastal fishery development. Cunningham (1995) pointed out that the fisheries sector cannot be managed in isolation, and thus, there is a strong need to consider the inter-relationships between fisheries and other users of coastal resources. In the Philippines, various programs and projects were initiated using the ICM approach to promote sustainable fisheries development (Muñoz 1997; Christie and White 1997; Courtney and White 2000). While it is acknowledged that fisheries should be put in context within the broader ICM, marine fisheries can be studied as a distinct but a related part of the entire coastal system. In fact, the integration will vary depending on the relative importance of fisheries in a particular coastal setting (Figure 3) (Silvestre 1996). Some coastal areas are largely fisheries-oriented. In San Miguel Bay (Bicol region, Philippines), for example, the fisheries sector is paramount. Many other coasts, however, are moving towards modernization with fisheries either competing or co-existing with other economic sectors. Examples are the industrialized coasts of Batangas Bay and Manila Bay.

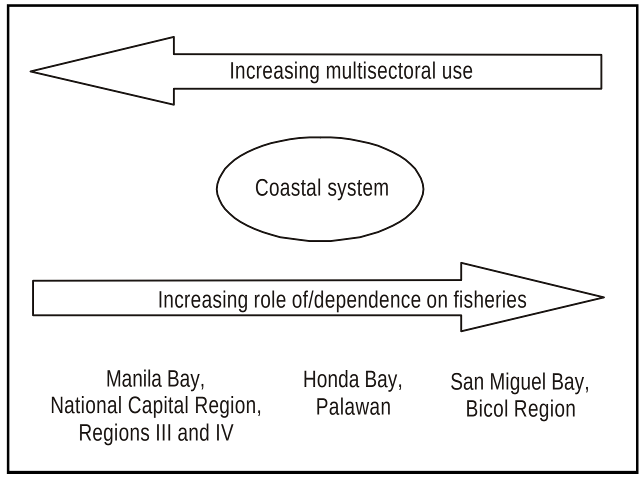


Figure 3. Typology/spectrum of capture fisheries management in the Philippines.

The translation of the ecologically sustainable development concept in the Philippines into practical actions to improve the national economy (Cabrido 1997) and the fisheries sector (De Sagun 1992; Barut *et al.* 1997) remains a topic of debate. Incorporating fisheries management into the ICM framework is difficult and the process is time-consuming. There are positive developments, though, such as the integration of fisheries concerns in Honda Bay in the overall development concerns of Puerto Princesa City, Palawan. A key challenge is the development of comprehensive sea-use zoning schemes where fishing will operate in appropriate locations that are not in conflict with and/or supportive of other economic activities. In the case of San Miguel Bay, an integrated coastal fisheries management plan has been effectively linked with relevant municipal and provincial development plans (Silvestre 1996). It appears that Philippines-wide, “without such integration, it is likely that optimum use of society’s fisheries resources will not be achieved and, indeed, the future of fisheries in coastal areas is likely to be seriously threatened” (Scialabba 1998). ICM may therefore provide a more dynamic and holistic approach to capture fisheries management given that the demand for fisheries products is increasing and multiple uses are putting more pressure on the coastal resource system.

References

Barut, N.C., M.D. Santos, and L.R. Garces. 1997. Overview of Philippine marine fisheries, p. 62-71. *In* G. Silvestre and D. Pauly (eds.) Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

Burke, L., E. Selig and M. Spalding. 2002. Reefs at risk in Southeast Asia. World Resources Institute, Washington, DC, USA. 72 p.

Cabrido, C. 1997. Sustainable development indicators: Philippine government initiatives. SCOPE Rep. 58, 344 p.

Chia, L.S. and H. Kirkman. 2000. Overview of land-based sources and activities affecting the marine environment in the East Asian Seas. EAS/RCU Reg. Seas Rep. Stud. Ser., 74 p.

Chou, L.M., C. Wilkinson, E. Gomez and S. Sudara. 1994. Status of coral reefs in the ASEAN region, p. 8-12. *In* C. R. Wilkinson (ed.) Living coastal resources of Southeast Asia: Status and management. Australian Institute of Marine Science, Townsville, Australia.

Christie, P. and A.T. White. 1997. Trends in development of coastal area management in tropical countries: From central to community orientation. Coast. Manage. 25: 155-181.

Chua, T.-E. 1996. Lessons learned from successes and failures of integrated coastal management initiatives. MPP-EAS Tech. Rep. No. 4, 90 p.

Chua, T.-E. 1997. Application of integrated coastal management system for sustaining coastal fishery development, p. 39-51. *In* Proceedings of the Workshop of Asia-Pacific Fishery Commission, 15-18 October 1996, Seoul, Korea.

Chua, T.-E. 1998. Lessons learned from practicing integrated coastal management in Southeast Asia. Ambio 27(8): 599-610.

Chua, T.-E., G. Silvestre, J. Paw, M. Pido and C. Luna. 1992. Coastal area management as framework for sustainable development of coastal fisheries: Initiatives in Southeast Asia. FAO Fish. Rep. No. 474. Suppl. 1: 337-377.

Cicin-Sain, B. and R. Knecht. 1998. Integrated coastal and ocean management: Concepts and practices. Island Press, Washington, USA.

Courtney, C.A. and A.T. White. 2000. Integrated coastal management in the Philippines: Testing new paradigms. Coast. Manage. 28: 39-53.

Cunningham, S. 1995. Integrating fisheries into coastal area management. CEMARE Res. Pap. No. 83, 13 p. Portsmouth, UK.

De Sagun, R.B. 1992. The Local Government Code and its provisions on fisheries. Fishery Resources Administration Division, Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

FSP-PMO (Fisheries Sector Program-Program Management Office). 1991. Fisheries Sector Program. Department of Agriculture, Quezon City, Philippines.

Gabric, A.J. and P.R.F. Bell. 1994. Review of the effects of non-point nutrient loading on coastal ecosystems. Aust. J. Mar. Freshwat. Res. 44: 261-283.

GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 1996. The contributions of science to coastal management. GESAMP Rep. Stud. No. 61, 66 p.

GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 2001. A sea of troubles. GESAMP Rep. Stud. No. 70, 35 p.

Goldberg, E.D. 1995. Emerging problems in the coastal zone for the twenty-first century. Mar. Pollut. Bull. 31(4-12): 152-158.

Hotta, M. 1996. Regional review of the fisheries and aquaculture situation and outlook in South and Southeast Asia. FAO Fish. Circ. 904, 45 p.

ICLARM (International Center for Living Aquatic Resources Management). 1999. ICLARM strategic plan 2000-2020. ICLARM, Makati City, Philippines. 27 p.

Menasveta, D. 1998. APFIC: Its evolution, achievements and future direction. RAP Publ. 1998/15, 114 p. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand.

Muñoz, J.C. 1997. Integrated coastal resource management system (ICRM) as a tool for sustainable fisheries, p. 129-141. *In* Proceedings of the Workshop of the Asia-Pacific Fishery Commission, 15-18 October 1996, Seoul, Korea.

Olsen, S.B. 1993. Will ICM programs be sustainable? The constituency problem. Ocean Coast. Manage. 21(1-3): 201-225.

Rawlings, B.G., A.J. Ferguson, P.J. Chilton, R.S. Arthurton, J.G. Rees and J.W. Baldock. 1998. Review of agricultural pollution in the Caribbean with particular emphasis on small island developing states. Mar. Pollut. Bull. 36(9): 658-668.

Scialabba, N., Editor. 1998. Integrated coastal area management and agriculture, forestry and fisheries: FAO guidelines. Environment and Natural Resources Service, Food and Agriculture Organization, Rome, Italy. 256 p.

Scura, L.F. 1993a. Review of recent experiences in integrated coastal management: ICLARM and URI. Paper submitted to the United Nations Food and Agriculture Organization, Rome, Italy. 20 p.

Scura, L.F. 1993b. Typological framework and strategy elements for integrated coastal fisheries management. Paper submitted to the United Nations Food and Agriculture Organization, Rome, Italy. 20 p.

Scura, L.F., T.-E. Chua, M.D. Pido and J. Paw. 1992. Lessons for integrated coastal zone management: The ASEAN experience, p. 1-70 . *In* T.-E. Chua and L.F. Scura (eds.) Integrative framework and methods for coastal area management. ICLARM Conf. Proc. 37, 169 p.

Silvestre, G.T. 1996. Integrated management of coastal fisheries: Lessons from initiatives in San Miguel Bay, Philippines. International Center for Living Aquatic Resources Management, Manila, Philippines. 13 p.

Silvestre, G. and D. Pauly, Editors. 1997. Status and management of tropical coastal fisheries in Asia. ICLARM Conf. Proc. 53, 208 p.

Smith, C.L. 1988. Conservation and allocation decisions in fishery management, p 131-138. *In* W.J. McNeil (ed.) Salmon production, management and allocation: biological, economic and policy issues. Oregon State University Press, Oregon, USA.

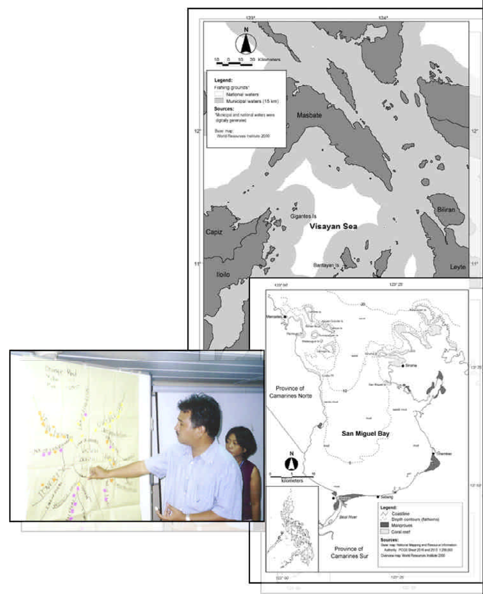
Sorensen, J.C., S.T. McCreary and M.J. Hershman. 1984. Institutional arrangements for management of coastal resources. Coast. Manage. Publ. No.1. US National Park Service, USA. 165 p.

Talaue-McManus, L. 2000. Transboundary diagnostic analysis for the South China Sea. EAS/RCU Tech. Rep. Ser. No. 14.

UN (United Nations). 1993. The global partnerships for environment and development: A guide to Agenda 21 post Rio edition. New York, UN, USA.

SECTION IV

Case Studies in Fisheries Assessment and Management



Status of Lingayen Gulf Fisheries - A Brief Update[1]

GERONIMO T. SILVESTRE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

VINCENT V. HILOMEN
Animal Biology Division, Institute of Biological Sciences
University of the Philippines-Los Baños
College, Laguna 4031
Philippines

Background

Lingayen Gulf is located in the northwestern part of Luzon bordering the South China Sea, within latitudes 16°00' N and 16°40' N and longitudes 119°55' E and 120°25' E (Figure 1). It is bounded in the west and south by the province of Pangasinan and in the northeast by La Union province. The gulf has a total area of 2,085 km² and is mostly shallow, with about 90% of its area below 90 m. A series of shoals extends nearly halfway across its entrance from Cape Bolinao. Its central and northern entrances are also studded with coralline growth. From the southern and central portions of the gulf to the eastern coast, the substrate is generally muddy with occasional patches of hard / rocky bottom. Based on bottom type and ecosystem characteristics, the gulf is often subdivided into three sectors (Mines 1986; Silvestre 1990a), namely: (1) Sector I (western coast) – extends from Cape Bolinao to Sual, characterized by coral reefs and seagrass beds; (2) Sector II (inner coast) – extends from Sual to Damortis, characterized by muddy substrate, mangroves and nipa swamps, and where aquaculture activities are concentrated; and (3) Sector III (eastern coast) – bounded by the coast of La Union, characterized by generally soft and muddy substrate. Sixteen municipalities and one city (Dagupan) border Lingayen Gulf from Cape Bolinao to Poro Point.

Lingayen Gulf is a major traditional fishing ground in the Philippines. It supplies fish and fishery products to coastal inhabitants in the gulf as well as many parts of northwestern Luzon. In 2001, catch was about 6,500 t (Hilomen *et al.* 2002) from fishing operations by about 16,000 municipal fishers, 28 commercial trawlers and 52 Danish seiners in the area (Hilomen and Jimenez 2001). About 47% of municipal fishers are based in Sector I, 30% in Sector II and 23% in Sector III (Table 1). Most of the trawlers are based in Sual, Dagupan City and Metro Manila (operating seasonally). Most of the Danish seiners are based in Dagupan City and Mangaldan. Over 33 types of municipal fishing gears are used (Calud *et al.* 1989). Currently, most of the municipal fishers use various types of gillnet (52.7%), hook and line (12.2%), baby trawl (8.4%) and fish corral (7.6%) (Table 1). A multiplicity of species comprises catch in the gulf. Over 159 species belonging to 87 genera and 55 families have been reported to occur regularly in the catch (Mines 1986).

A substantive body of assessments documents the status of coastal resources and fisheries in Lingayen Gulf through time (see for example Warfel and Manacop 1950; FIDC-NRMC 1980; Fox 1986; Mines 1986; McManus and Chua 1990; Silvestre 1990a and 1990b; Silvestre *et al.* 1989, 1991; Ochavillo and Silvestre 1991; McManus 1996; Hilomen and Jimenez 2001; McGlone and Villanoy 2001; Hilomen *et al.* 2002). These studies provide detailed treatments of the main management issues impacting fisheries in the gulf and corresponding options to resolve or mitigate them. This paper draws selectively from these studies to provide a brief update and synoptic

[1] This paper can be cited as follows: SILVESTRE, G.T. and V.V. HILOMEN. 2004. Status of Lingayen Gulf fisheries – a brief update, p. 285-291. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

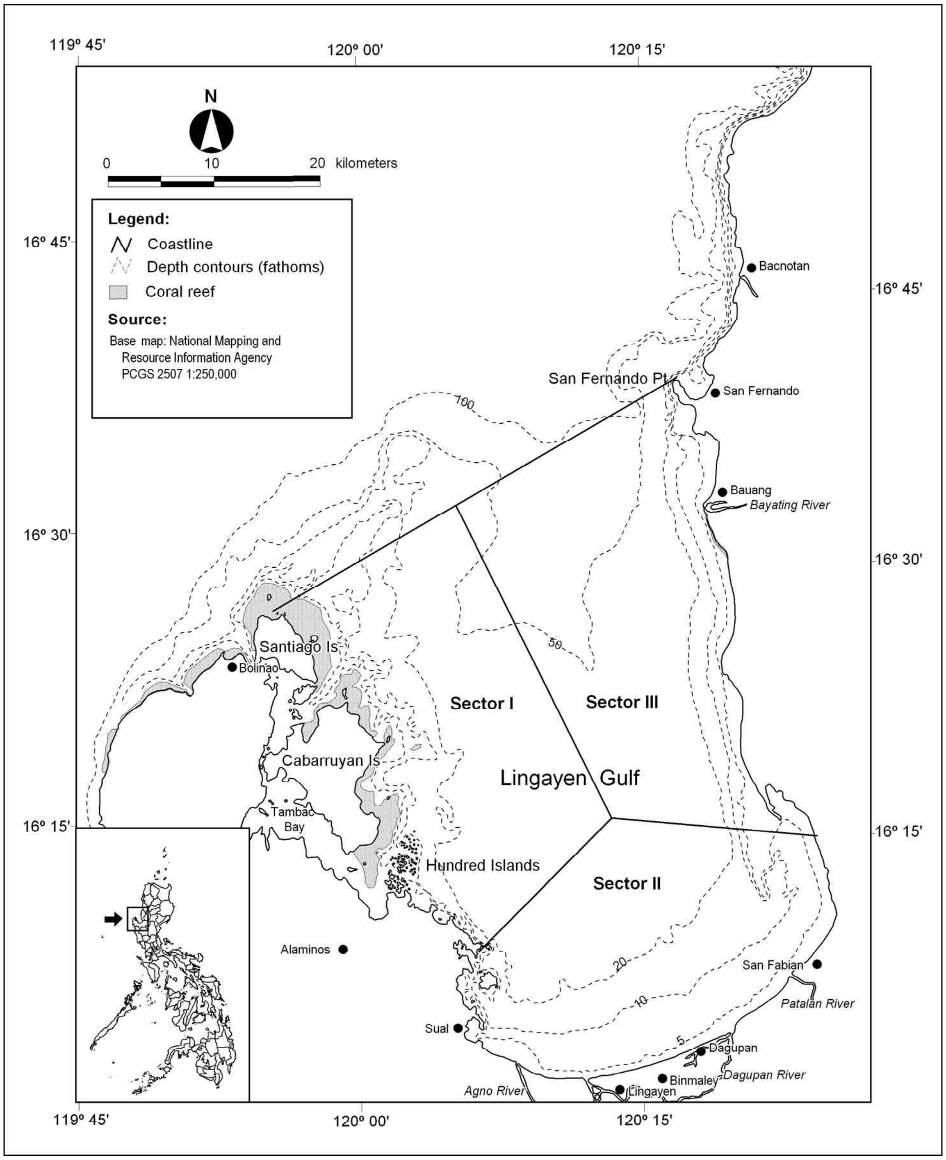


Figure 1. Map of Lingayen Gulf showing coastal features and subdivision of its internal waters (Sectors I – III). Isobaths indicated are in fathoms.

picture of the fisheries situation. Interested readers are referred to these references for more details.

Exploitation Status

The available assessments indicate that the fisheries in Lingayen Gulf suffer from excessive fishing pressure since the late 1970s. This has led to biological and economic overfishing that has continuously aggravated until the present time. As early as 1976, the Bureau of Fisheries and Aquatic Resources declared the gulf to be overfished based on comparisons of catch and potential production per unit area (Smith *et al.* 1980). Based on essentially the same approach, the Fishery Industry Development Council and the Natural Resources Management Center (FIDC-NRMC 1980) came to the same conclusion. Fox (1986) noted that the gulf is overfished based on countrywide comparison of fisher density and catch per unit area. Mines (1986) concluded that the fishing sector suffers from overfishing, low and declining catch rates, increasing conflict among fishers, and use of explosives and poisons in fishing.

Figure 2 illustrates relative indices of demersal biomass and (municipal and commercial) fishing effort in the gulf from the late 1930s to the late 1980s. The figure depicts the situation in the late 1980s based on consolidation by Silvestre (1990b) of available assessments at the time. Note the rapid increase in the number of municipal fishers and trawl units between the late 1970s and the late 1980s. This has led to decimation of resource abundance to as low as 15% of

Table 1. Number of municipal fishers using various types of fishing gear in Lingayen Gulf, 2001 (Hilomen and Jimenez 2001).

Gear Type	Province/Sector Pangasinan I	Pangasinan II	La Union III	Total No.	Total %
Baby trawl - baby otter trawl, *karkar, taksay,* trawl and trawl net	0	576	771	1,347	8.40
Fish corral – *pasabing* and *baklad*	1,226	0	0	1,226	7.65
Fish trap – fish pot, *kasag* and *nasa*	340	0	28	368	2.29
Gillnet – surface gillnet, bottom set gillnet, drift gillnet, tuna drift gillnet, *paltaw, sayudsod, sigay* and *taba*	2,759	3,911	1,782	8,452	52.71
Hook and line – longline, *baniit, bingwit, kawil, kitang,* short longline and multiple hook-and-line	1,201	57	700	1,958	12.21
Lift net – *bintol* and *lamp*	480	50	0	530	3.31
Spear – *pana* and spear with light	189	0	0	189	1.18
Dredge – *kadkad* and *cadcad*	125	0	0	125	0.78
Gleaners	191	0	0	191	1.19
Others – beach seine, *dakles,* jigger, *kariskis, legma, mannunyo,* mosquito net, *sagap,* screen net, shrimp trawl net, *sillem,* "skylab", *tabukol* or cast net, *basnig* or bagnet and others	1,067	170	413	1,650	10.28
Total	7,578	4,764	3,694	16,035	100.00

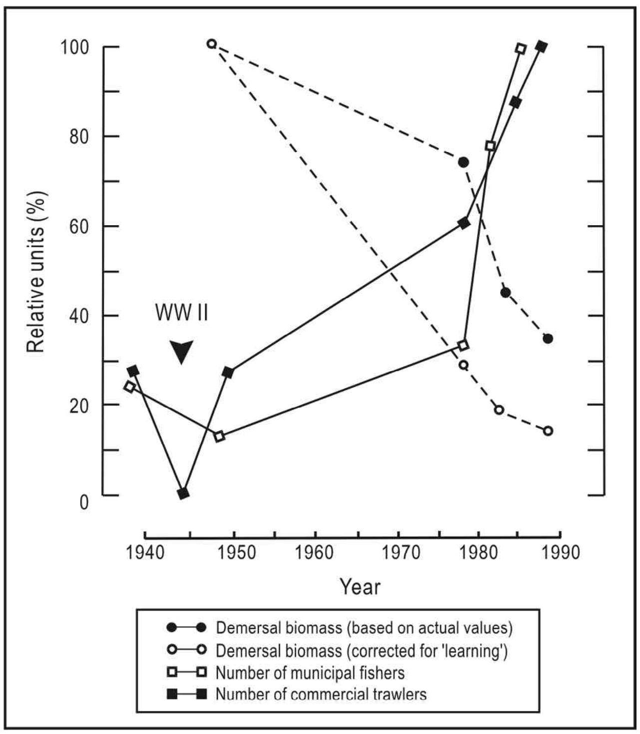


Figure 2. Relative indices of demersal biomass and number of municipal fishers and commercial trawlers in Lingayen Gulf from the late 1930s to the late 1980s (Silvestre 1990b).

the original abundance levels reported in the late 1940s. Conventional fisheries models indicate that such low abundance levels (below 33%-50% of original levels) indicate excess fishing pressure and biological overfishing of the resources. Species-specific assessments during the late 1980s (see Silvestre 1990b; Silvestre *et al.* 1991) indicate very high exploitation ratios (mean of 0.61) and confirm the overfishing situation. The problem of overfishing resulting from excess fishing pressure is also aggravated by the capture of undersized fishes, resulting in losses of about 25% and 35% in volume and value of catches, respectively (Ochavillo *et al.* 1989; Ochavillo and Silvestre 1991).

Economic analyses of fisheries in Lingayen Gulf in the late 1980s indicate elements of economic overfishing (see Silvestre 1990b; Cruz and Silvestre 1991 and references therein). Table 2 gives the results of these studies for selected municipal and commercial fishing units which indicate the following: (1) positive pure profit (i.e., economic rent) in commercial trawl operations only because of depressed labor cost; (2) negative pure profit in bottom gillnet operations (the most predominant gear in the area); (3) positive pure profit for other gears only due to depressed opportunity cost for labor in the area. The results indicate that fishing continues despite the low incomes derived because of the absence of income alternatives. Note in this context that the sum of labor cost and pure profit ($340-580) is below the mean fishing household expenditure ($750) per year in the area. Moreover, there is substantial underemployment among municipal fishers indicated by the low number of fishing days (109-128) per year.

The decimation of resource abundance and conditions of biological and economic overfishing has worsened since the assessments noted above were

Table 2. Estimates of annual revenue, costs and pure profit in $ in 1987 for selected types of fishing gear used in Lingayen Gulf (Silvestre 1990b; Cruz and Silvestre 1991).

Fishing Sector/Gear Type	Total Revenue	Labor Cost[a]	Operating Cost[b]	Pure Profit
Municipal[c]				
Bottom gillnet	450	190	280	-20
Baby trawl	1,120	220	710	190
Liftnet	870	190	580	100
Longline/dynamite	1,080	220	470	390
Commercial	50,400	3,900[e]	45,500	1,000
Medium trawl[d]	50,400	5,800[f]	45,500	-900

[a] Opportunity cost of labor assumed to be $1.70/day of operation (i.e., one-half of mandated minimum wage for nonagricultural workers outside Metro Manila), unless indicated otherwise.
[b] Includes all fixed and variable costs, as well as opportunity cost of capital invested (i.e., assumed equal to prevailing savings interest rate of 5% per year).
[c] Number of fishing days per year were 109, 113 and 128 for bottom gillnet, liftnet, and baby trawl/longline/dynamite fishing operations, respectively. Mean municipal fishing household expenditure (for food, clothing, etc.) in 1987 was $750/year.
[d] Average of 100 trawl trips per year at 2 days/trawl trip.
[e] Includes managerial opportunity cost ($1,180/year) and labor cost for 8 persons at $340/person/year.
[f] Includes managerial opportunity cost ($1,180/year) and labor cost (average of $578/person/year for 8 persons) based on average actual compensation and benefit structure given by trawl operators.

Table 3. Comparison of the number of municipal fishers in Lingayen Gulf in 1985 and 2001 (Hilomen and Jimenez 2001).

Sector	Municipality	1985		2001		% Change
	Pangasinan		10,286		12,342	19.99
I			5,740		7,578	32.02
	Bolinao	2,670		2,936		9.96
	Anda	1,492		1,054		-29.36
	Bani	288		236		-18.06
	Alaminos	566		2,504		342.40
	Sual	724		848		17.13
II			4,546		4,764	4.80
	Labrador	900		311		-65.44
	Lingayen	1,800		2,946		63.68
	Binmaley	56		105		87.50
	San Fabian	600		753		25.50
	Dagupan	1,190		649		-45.46
	La Union		2,178		3,693	69.57
III			2,178		3,693	69.57
	Rosario	58		241		315.52
	Sto. Tomas	336		1,286		282.66
	Agoo	464		1,478		218.53
	Aringay	313		515		64.38
	Caba	116		174		50.00
	Bauang	532		nd		
	San Fernando	359		nd		
Total			12,464		16,035	28.65

conducted based on data for the late 1980s. Fishing effort has substantially increased recently. Hilomen and Jimenez (2001) noted an increase of about 29% in the number of municipal fishers (Table 3), and an increase in the number of commercial boats (from 26 trawlers in 1987-1988 to 28 trawlers and 52 Danish seiners in 2000-2001). They noted, however, that the gross tonnage of commercial boats have declined and have increasingly shifted operations outside the gulf.

The effect of further increases in fishing effort given the already overfished conditions has been a substantive decline in total catch from the gulf (Hilomen *et al.* 2002) (Figure 3). This has also led to substantive declines in catch rates of municipal and commercial fishing units (Table 4), with negative impacts on incomes, fish supply and poverty in coastal

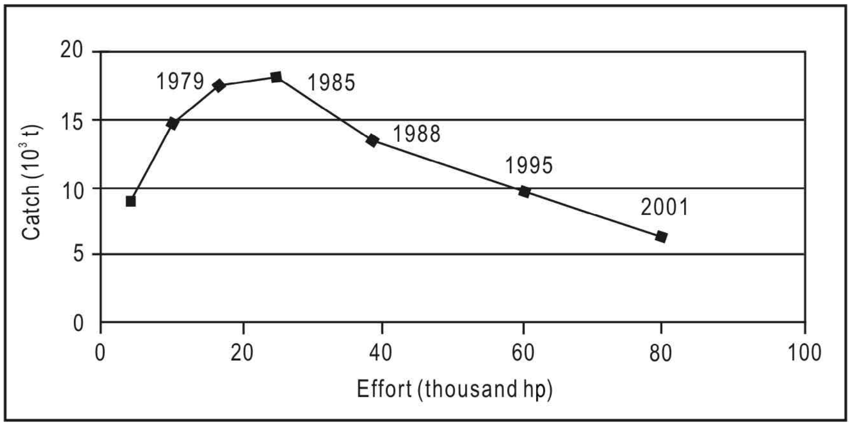


Figure 3. Trend of catch and fishing effort in the Lingayen Gulf fisheries (Hilomen *et al.* 2002).

communities. Biological and economic overfishing resulting from excessive fishing pressure has not only decimated the fisheries resources and economic benefits from fisheries, but has also altered the composition of the resources substantially. Table 5, for example, summarizes the changes observed in trawl survey catches from the late 1940s to the late 1980s. The evident stock alterations include, among others, the following: (1) relative increase in squids (cephalopods), triggerfish and "trash" fish components; (2) virtual disappearance of large species such as rays and lactarids; and (3) relative decrease of slipmouths, lutjanids (snappers) and flatfishes. Overall, these trends indicate severe overfishing which threatens the sustainability of fisheries in the gulf.

Key Fisheries Management Directions

Many ecological, economic, social and institutional issues impact the fisheries in Lingayen Gulf. The host of issues has been conclusively documented in detail by the substantive body of assessments cited above. Appropriate management directions (in terms of strategies and actions) to resolve or mitigate the issues have resulted from these assessments, taking the form of various plans and programs at the municipal, provincial and regional levels. Briefly outlined below are the key issues and management directions evident from these assessments and management programs.

The main problems impacting fisheries in the gulf are overfishing and degradation of coastal habitats (including reefs and mangroves). These require removal of excess fishing capacity and rehabilitation of coastal habitats (including wider use of protected areas and reduction of coastal environmental impacts). Addressing overfishing will also need improved management including, among others, the following: (1) replacement of *de facto* open access systems with rights-based licensing schemes; (2) redirection of fishing capacity through alternative livelihood and investment opportunities; (3) regulation of appropriate mix of fishing gears consistent with sustainable fisheries (including elimination of blast and cyanide fishing); (4) formulation and implementation of zonation schemes to minimize gear conflicts and optimize yields and incomes; (5) institutionalization of participation by fishers and other stakeholders in enforcement and management; (6) reduction of environmental impacts of fishing and post-harvest (value) losses; (7) upgrading of the policy, regulatory and administrative system for fisheries in the gulf. These measures require a wider constituency of stakeholders, necessitating improved information, education and extension programs. Moreover, they require improved research inputs and utilization. Sustaining management efforts over the long-term will also need strengthening of local capabilities in these fields. Overall, the combined management and rehabilitation efforts should rebuild coastal fish stocks and habitats to more productive

Table 4. Comparison of catch rates (kg/trip) for various types of fishing gear used in Lingayen Gulf in 1985-1988 and 2000-2001 (Hilomen and Jimenez 2001).

Fishery	1985-1988	2000-2001[a]	% Decrease
A. Municipal			
Gillnet	15.25[b]	11.04	38.20
Hook and line	7.08[b]	3.15	124.50
Fish corral	4.35[b]	0.90	384.60
Fish trap	2.10[b]	1.75	23.20
Baby trawl	31.30[c]	14.68	113.20
B. Commercial			
Danish seine	26.80[b]	14.17	89.20
Trawl	31.80[d]	15.37	106.90

[a]Hilomen and Jimenez (2001).
[b]Calud *et al.* (1989).
[c]Mines (1986).
[d]Ochavillo *et al.* (1989).

Table 5. Change in relative abundance of various families/groups in trawl survey catches in Lingayen Gulf from the late 1940s to the late 1980s with increasing fishing pressure and technological innovations (Silvestre 1990b).

Family/Group	Observed Change in Relative Abundance	Probable Cause
Cephalopods	Relative increase	Reduced predation
Lactaridae	Disappearance	Recruitment overfishing
Dasyatidae	Disappearance	Recruitment overfishing
Balistidae	Relative increase	Species replacement
Lutjanidae	Relative decrease	Growth and recruitment overfishing
"Trash" fish		
Low-value species (e.g., Apogonidae)	Relative increase	Reduced predation, species replacement
Juveniles of high-value species	Relative increase	Growth overfishing
Leiognathidae	Massive decrease	No straightforward explanation
Carangidae, Scombridae, Engraulidae and Trichluridae	Relative increase	Technological (higher trawl opening and trawl speed)

levels, thereby restoring catches and incomes and mitigating poverty in the gulf area.

Evidently, the problems persist and have worsened through the years due to mounting use pressures and lack of effective, integrated and sustained implementation of requisite management strategies and actions. The greatest challenge lies in overcoming such "paralysis of implementation" in the management of fisheries in the gulf. We note, moreover, that the fisheries problems represent local symptoms of the wider national environment and resources degradation resulting from poverty and underdevelopment. Ultimate solutions, therefore, to the fisheries problems in the gulf also depend on the progress made by the country in promoting wider economic growth, social equity, population management and overall national development in a globalized economy.

References

Calud, A., G. Rodriguez, R. Aruelo, G. Aguilar, E. Cinco, N. Armada and G. Silvestre. 1989. Preliminary results of a study of the municipal fisheries in Lingayen Gulf, p. 3-29. *In* G. Silvestre, E. Miclat and T.E. Chua (eds.) Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines. ICLARM Conf. Proc. 17, 200 p.

Cruz, A. and G.T. Silvestre. 1991. Economic analysis of medium trawlers in Lingayen Gulf. Fish. Res. J. Philipp. 13(1-2): 1-14.

FIDC-NRMC (Fishery Industry Development Council and Natural Resources Management Center). 1980. Assessment of Philippine fishery wealth (marine sector): A Delphi approach. FIDC-NRMC, Quezon City, Philippines. (Unpublished).

Fox, P. 1986. A manual of rapid appraisal techniques for Philippine coastal fisheries. Research Division, Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 43 p.

Hilomen, V.V. and L.F. Jimenez. 2001. Status of fisheries in Lingayen Gulf (Appendix 1). *In* M. McGlone and C. Villanoy (eds.) Resource and social assessment of Lingayen Gulf. Project Report submitted to the Fisheries Resource Management Project, Department of Agriculture. Marine Science Institute, University of the Philippines and the Marine Environment and Resources Foundation, Quezon City, Philippines.

Hilomen, V.V., W. Licuanan, P. Aliño and L. Jimenez. 2002. Status of the fisheries resources in Lingayen Gulf: Easing the pressure and enhancing the resources. Paper presented at the National Conference on Fisheries Resource and Social Assessments, Development Academy of the Philippines, Tagaytay City. Fisheries Resource Management Project, Department of Agriculture, Quezon City, Philippines.

McGlone, M. and C. Villanoy, Editors. 2001. Resource and social assessment of Lingayen Gulf. Project Report submitted to the Fisheries Resource Management Project, Department of Agriculture. Marine Science Institute, University of the Philippines and the Marine Environment and Resources Foundation, Quezon City, Philippines.

McManus, J.W. 1996. Social and economic aspects of reef fisheries and their management, p. 249-281. *In* N.V.C. Polunin and C.M. Roberts (eds.) Reef fisheries. Chapman and Hall, London, UK.

McManus, L.T. and T.E.Chua, Editors. The coastal environmental profile of Lingayen Gulf, Philippines. ICLARM Tech. Rep. 22, 69 p.

Mines, A. 1986. Assessment of the fisheries of Lingayen Gulf. Project Report submitted to the Philippine Council for Agriculture and Resources Research and Development, National Science and Technology Authority. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines-Visayas, Quezon City, Philippines. 55 p.

Ochavillo, D. and G.T. Silvestre. 1991. Optimum mesh size for the trawl fisheries of Lingayen Gulf, Philippines. p. 41-44. *In* L.M. Chou, T. E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong (eds.) Towards an integrated management of tropical coastal resources. ICLARM Conf. Proc. 22, 445 p.

Ochavillo, D., H. Hernandez, S. Resma and G. Silvestre. 1989. Preliminary results of a study of the commercial trawl fisheries in Lingayen Gulf, p. 31-42. *In* G. Silvestre, E. Miclat and T.E. Chua (eds.) Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines. ICLARM Conf. Proc. 17, 200 p.

Silvestre, G.T. 1990a. Capture fisheries, p. 15-28. *In* L.T. McManus and T.E.Chua (eds.) The coastal environmental profile of Lingayen Gulf, Philippines. ICLARM Tech. Rep. 22, 69 p.
Silvestre, G.T. 1990b. Overexploitation of the demersal stocks of Lingayen Gulf, Philippines, p. 873-876. *In* R. Hirano and I. Hanyu (eds.) The Second Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines. 991 p.
Silvestre, G.T., E. Miclat and T.E. Chua, Editors. 1989. Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines. ICLARM Conf. Proc. 17, 200 p.
Silvestre, G.T., N. Armada and E. Cinco. 1991. Assessment of the capture fisheries in Lingayen Gulf, Philippines. p. 25-36. *In* L.M. Chou, T.E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong (eds.) Towards an integrated management of tropical coastal resources. ICLARM Conf. Proc. 22, 445 p.
Smith, I.R., M.Y. Puzon and C.N. Vidal-Libunao. 1980. Philippine municipal fisheries: A review of resources, technology and socio-economics. ICLARM Stud. Rev. 4, 84 p.
Warfel, H.E. and P.R. Manacop. 1950. Otter trawl explorations in Philippine waters. Fish and Wildlife Service, Department of the Interior, Washington, DC, US. Res. Rep. 25, 49 p.

Status of Fisheries in San Miguel Bay[1]

GERONIMO T. SILVESTRE
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

VINCENT V. HILOMEN
Animal Biology Division, Institute of Biological Sciences
University of the Philippines-Los Baños
College, Laguna 4031
and
SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA)
College, Los Baños, Laguna 4031
Philippines

Background

San Miguel Bay is located in the Bicol region on the Pacific coast of Luzon at around 14º N latitude and 123º E longitude (Figure 1). Recent assessments detailing the biophysical and socioeconomic background of fisheries in the bay are given, among others, in the various contributions in Silvestre *et al.* (1992, 1995a). San Miguel Bay is a shallow, estuarine body of water with an area of 1,115 km^2. Depth (averaging 7.4 m) and salinity increases northward from the outfall of the Bicol River (near Cabusao) to the mouth of the bay facing the Pacific Ocean. About 95% of the bay has soft (muddy / sandy) substrate, and reef areas (about 38 km^2) are concentrated in the northern part of the bay where marine conditions prevail. Remaining mangrove areas (about 14 km^2) are found mostly near the outfall of the Bicol River, near Mercedes municipality, and the eastern parts of the bay. A total of 12 river systems drain into the bay with a combined catchment area of 3,320 km^2. The Bicol River basin comprises about 70% of this total catchment area. The entire catchment area consists mostly of agricultural lands (coconut plantations and rice farms) and secondary forests or shrublands. It also encompasses the main population centers of Daet, Naga and Iriga City.

Seven coastal municipalities border San Miguel Bay, namely: Mercedes and Basud (Camarines Norte province), and Sipocot, Cabusao, Calabanga, Tinambac and Siruma (Camarines Sur province). There are about 79 coastal villages (barangays) in these seven municipalities with a projected population of about 115,000 persons in 2001. The coastal villages, occurring in largely rural development settings, are characterized mostly by depressed socioeconomic conditions, particularly in the eastern parts of the bay. Poverty incidence is above the national average and underemployment (already at a high 35% in these villages in the early 1990s) is believed to have worsened with increasing population, limited economic opportunities, and geographic and occupational immobility. Fishing is a main source of livelihood for residents of coastal villages. About 7,000 municipal fishers fish in the bay, 67% of which are from Mercedes, Calabanga and Siruma, 27% from Tinambac and Cabusao, and 6% from Sipocot and Basud (Hilomen *et al.* 2003). In addition, commercial trawlers (while banned in the bay which consists of municipal waters) occasionally operate within the bay and compete with municipal fishers for available resources.

The first investigation of fisheries in San Miguel Bay dates back to Umali (1937). Subsequent works (e.g., Warfel and Manacop 1950; Legasto *et al.* 1975; Simpson 1978) dealt only with selected aspects of the fisheries. It was the 1979-1981 investigations of the International Center for Living Aquatic Resources Management

[1] This paper can be cited as follows: SILVESTRE, G.T. and V.V. HILOMEN. 2004. Status of fisheries in San Miguel Bay, p. 292-299. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

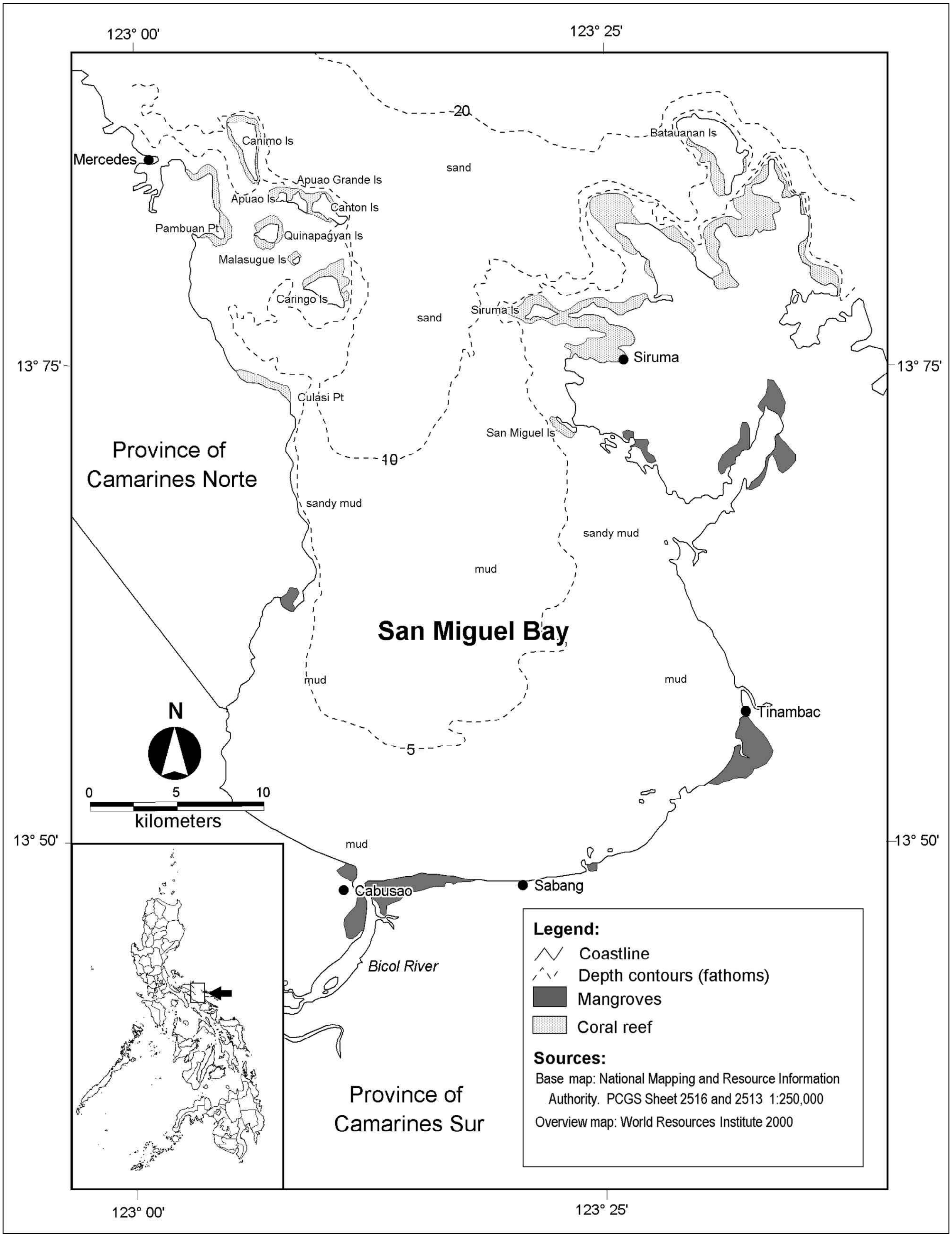


Figure 1. Map of San Miguel Bay showing coastal municipalities and biophysical features.

(ICLARM), however, which provided the first detailed assessments of the biophysical (Pauly and Mines 1982), economic (Smith and Mines 1982), social (Bailey 1982a, 1982b) and institutional (Smith *et al.* 1983) aspects of fisheries in the bay. These assessments provided a systematic diagnosis of the fisheries situation (characterized, among others, by overfishing and inequity favoring trawlers over the larger number of municipal fishers) and appropriate research and management options in response to prevailing issues (Smith *et al.* 1983). Many of the issues were noted to have persisted due to lack of concerted efforts to implement management recommendations (Smith and Salon 1987). Subsequent detailed assessments and provision of management options in 1992-1993 under the auspices of the Fisheries Sector Program (e.g., Silvestre *et al.* 1992, 1995a; PMO / FSP / DA-SMBMC-ICLARM 1995) and in 2001-2002 under the auspices of the Fisheries Resources Management Program (Hilomen *et al.* 2003) indicate, among others, that the problem of overfishing has worsened. This contribution attempts to provide only a brief update of the status of fisheries in San Miguel Bay. Interested readers are referred to the assessments cited above for more detailed treatments.

Catch and Fishing Effort

Numerous fishing gears (as much as 46 distinct types) are used by fishers to exploit the multispecies resources in San Miguel Bay (Silvestre *et al.* 1995b). Table 1 gives estimates of annual catch and effort by type of fishing gear used in San Miguel Bay based on studies conducted during the period 2001-2002 (Hilomen *et al.* 2003). A total of 6,712 fishing gear units are used in the bay. The most numerous gears are gillnet, mini trawl, hook and line, scissor or push net and longline. Apart from the Norway trawl, the rest of the gears are considered municipal gears. The Norway trawl is here considered “commercial” due to the size of the boats used to operate them. A number of fishing gears are not included in Table 1. These include blast fishing and cyanide fishing which are illegal but are known to occur in certain parts of the bay. Also, gears which are used very irregularly and contribute insignificantly to overall catch (e.g., cast net and dipnet) are not included in the table.

Annual catch during the 2001-2002 period was about 20,170 t, coming mostly from the use of trawl (52.7%) and gillnet (32.8%) gears. The fisheries in San Miguel Bay are essentially a trawl-gillnet fisheries with more

Table 1. Estimates of annual catch and fishing effort by gear type in San Miguel Bay based on studies conducted in 2001-2002 (Hilomen *et al.* 2003).

Gear Type	No. of Units	Trips/year	Catch Rate (kg/trip)	Annual Catch (t)	(%)
Trawl					
Baby trawl	75	132	490.0	4,851.0	24.05
Norway trawl	36	8	1,318.1	379.6	1.88
Mini trawl	679	217	36.6	5,392.8	26.73
Gillnet					
Bottomset gillnet	1,040	164	15.7	2,677.8	13.27
Crab gillnet	841	144	9.6	1,162.6	5.76
Drift gillnet	73	77	30.2	169.8	0.84
Hunting gillnet	249	186	26.9	1,245.8	6.18
Shrimp gillnet	805	167	7.6	1,021.7	5.06
Surface gillnet (shark)	3	31	14.6	1.4	0.01
Surface gillnet set	155	154	13.8	329.4	1.63
Others					
Stationary liftnet	41	142	47.6	277.1	1.37
Crab liftnet	137	172	1.4	33.0	0.16
Bottomset longline	381	113	19.8	852.4	4.23
Bottomset longline (shark)	2	72	61.0	8.8	0.04
Hook and line	585	149	3.9	339.9	1.69
Scissor net	444	174	4.7	363.1	1.80
Filter net	213	159	10.7	362.4	1.80
Fish corral	122	272	6.1	202.4	1.00
Fish trap	204	198	11.2	452.4	2.24
Crab pot	45	107	10.4	50.1	0.25
Others	582	-	-	-	-
Total	6,712	-	-	20,173.5	100.00

than 85% of the catch coming from these gears. Table 2 gives the most abundant families/groups comprising the catch. Over 250 species belonging to 70 families/groups occurred in the catch of various gears used. The annual catch was dominated by anchovies (Engraulidae), scads (Carangidae), sardines (Clupeidae), slipmouths (Leiognathidae), and mackerels (Scombridae). Note that the current composition of the catch is dominated more by pelagic families/groups (which are subject to high interannual variations in abundance) compared to those reported by Silvestre *et al.* (1995b) for the 1992-1993 period. Note also the increasing proportion of squids and priacanthids and the decline of sciaenids in the catch. These reflect the heavy fishing pressure in the bay, leading to increased proportion of squids and pelagics (which recruit from outside the bay) compared to demersals (which are more resident and severely overfished) (see above).

The historical development of catch and fishing effort in the bay from the end of World War II to the early 1980s has been reviewed in detail by Pauly (1982). From several hundred municipal fishing units (and the absence of trawling) immediately after World War II, fishing effort expanded to about 307 trawl units (119 commercial) and 3,226 municipal gear units by 1980-1981. Table 3 gives the trend of increase in fishing effort in the bay from the early 1980s to the early 2000s. The total number of gear units has increased tremendously from about 3,500 in the early 1980s to about 6,700 by the early 2000s. The number of gear units has increased for most gear types compared to the 1980-1981 base period, with the exception of commercial trawl, liftnet and scissor net units. Significantly, trawl and gillnet units more than doubled (from 307 to 790 and 1,345 to 3,409, respectively). A comparison of intensity of fishing operations (trips/year) between 1980-1981 and 2001-2002 shows increases for most gear types, with the exception of slight declines for gillnet and longline units and a substantive decline for commercial trawl (given decreasing intrusion into municipal waters) and filter net. Pauly (1982) and Smith *et al.* (1983) concluded that overfishing was already a problem with effort levels evident in the early 1980s. The tremendous increase in fishing effort since the early 1980s have substantive (long-term) negative implications on the resource base (see below), as well as on the catch rate, food security, income and living conditions of fishers in the bay.

Table 2. Comparison of catch composition in San Miguel Bay based on studies conducted in 1992-1993 and 2001-2002 (Silvestre *et al.* 1995b; Hilomen *et al.* 2003).

Family/Group	Rank		%	
	2001-2002	1992-1993	2001-2002	1992-1993
Engraulidae *(bolinao, dilis)*	1	6	37.7	9.0
Carangidae *(galunggong, matabaka)*	2	9	10.3	3.0
Clupeidae *(tamban, tunsoy)*	3	11	10.2	1.7
Leiognathidae *(koyog, sapsap, lawayan)*	4	2	7.4	12.4
Scombridae *(kabalyas, hasahasa)*	5	20	7.0	0.6
Sciaenidae *(abo, pagotpot, alakaak)*	6	1	5.9	13.5
Portunidae *(alimasag, kasag)*	7	5	2.6	9.8
Penaeidae *(hipon, pasayan, sugpo)*	8	3	2.5	11.8
Squid *(pusit)*	9	18	2.4	0.7
Priacanthidae *(dilat, burakat)*	10	-	2.3	-

Table 3. Annual fishing effort in San Miguel Bay based on independent studies conducted in 1980-1981, 1992-1993 and 2001-2003 (Pauly 1982; Silvestre *et al.* 1995b; Hilomen *et al.* 2003).

Gear Type	1980-1981		1992-1993		2001-2002	
	No. of Units	Trips/year	No. of Units	Trips/year	No. of Units	Trips/year
Trawl						
Mini	188	191	260	202	679	217
Others	119	103	55	125	111	150
Gillnet	1,345	156	2,670	171	3,409	132
Liftnet	171	53	60	115	41	157
Filter net	60	225	260	240	213	159
Scissor net	834	150	245	168	444	174
Longline	103	120	236	156	383	92
Other gears	713	170	953	163	1,432	182
Total	3,533		4,739		6712	

The catch in San Miguel Bay increased dramatically from about several hundred tons immediately after World War II to about 19,100 t during the 1980-1981 period (Pauly 1982). Table 4 gives estimates of annual catch by gear type in the bay during the early 1980s, early 1990s and early 2000s. Total catch dipped to about 17,800 t in the early 1990s from about 19,100 t in the early 1980s. This increased to about 20,200 t by the early 2000s with the trend of increase in fishing effort. The increased catch was made possible by shifts in composition of the catches (as noted above) and successful recruitment from outside the bay. It is noted, however, that the increased catch and fishing pressure (within and outside the bay) is essentially “mining” and (possibly irreversibly) altering the resource base, increasing the risk of wider perturbations in catches, and threatening the long-term sustainability of the fisheries. Currently, a large proportion of trawl catches already consist of jellyfishes (Hilomen *et al.* 2003), noted elsewhere to be symptomatic of excessive fishing pressure and biological overfishing (Silvestre *et al.* 1995b).

The data in Table 4 also confirm the persistence of the issue of inequity in catch distribution between the trawl and other municipal fishing units. In the early 2000s, about 53% of catches still go to trawl units. The intrusion of commercial trawlers into the bay has substantially abated, however, and only about 1.3% of the catch goes to commercial trawl units in the early 2000s compared to about 12.5% in the early 1980s.

Exploitation Status

A substantive body of assessments has accumulated since the pioneering work of Umali (1937) in San Miguel Bay. These assessments provide conclusive evidence of excessive fishing pressure and overfishing of the resources in the bay. As early as 1976, the Bureau of Fisheries and Aquatic Resources concluded that the bay was overfished based on comparisons of catch statistics with potential production per unit area (Smith *et al.* 1983). Following essentially the same approach, Simpson (1978) and the Fishery Industry Development Council and the Natural Resources Management Center (FIDC-NRMC 1980) concluded that demersal resources in the area were heavily exploited and overfished. The multidisciplinary assessments conducted by ICLARM in 1979-1981 (Bailey 1982a, 1982b; Pauly and Mines 1982; Smith and Mines 1982; Smith *et al.* 1983) documented in detail the issues of overfishing and inequity characterizing the fisheries. Based on countrywide comparison of catch rates and density of fishers, Fox (1986) also concluded that the fisheries resources in the bay were overfished. Smith and Salon (1987) noted further increases in fishing effort since the early 1980s which have aggravated the problem of excess fishing pressure. More recent assessments (e.g., Silvestre *et al.* 1992, 1995a; Hilomen *et al.* 2003) documented further expansion and shifts in fishing effort – further exacerbating the heavy fishing pressure and overfished condition of fishery resources in the bay.

Table 4. Annual catch by gear type in San Miguel Bay based on independent studies conducted in 1980-1981, 1992-1993 and 2001-2002 (Pauly 1982; Silvestre *et al.* 1995b; Hilomen *et al.* 2003).

Gear Type	1980-1981 (t)	1980-1981 (%)	1992-1993 (t)	1992-1993 (%)	2001-2002 (t)	2001-2002 (%)
Trawl						
Large and medium	2,385	12.47	332.6	1.87	5,230.6	25.93
Small and mini	9,291	48.57	5,806.1	32.71	5,392.8	26.73
Gillnet	4,854	25.38	7,550.0	42.53	6,608.5	32.76
Liftnet	624	3.26	1,021.2	5.75	277.1	1.37
Filter net	295	1.54	967.2	5.45	362.4	1.80
Scissor net	476	2.49	823.2	4.64	363.1	1.80
Longline	25	0.13	482.3	2.72	861.2	4.27
Other gears	1,178	6.16	770.1	4.34	1,077.8	5.34
Total	19,128.0	100.00	17,752.7	100.00	20,173.5	100.00

The deleterious impact of overfishing on fisheries resources in the bay can be illustrated by the substantive decimation of its demersal fish abundance. Table 5 gives estimates of demersal stock density in the bay based on trawl surveys conducted in the area during the period 1947-2002. Demersal fish abundance in the early 1990s was down to only 18.5% of its original levels in the late 1940s. Preliminary estimates from surveys in 2001-2002 (Hilomen *et al.* 2003) show that abundance levels have been further decimated to only about 2% of original levels, indicating severe overfishing. Conventional fisheries models suggest that fish stocks are overfished when their abundance is reduced below 33-50% of their original levels.

Species-specific assessments (e.g., Cinco and Silvestre 1995) indicate that exploitation ratios for species dominating catches in the bay have a mean value over 0.65. This is very high compared to optimal values (0.30-0.50) suggested by conventional fisheries models, and implies excessive fishing pressure from the mix of gears used in the bay. Moreover, such assessments show that most species are caught below sizes which will maximize biological yield (Pauly 1982; Cinco and Silvestre 1995; Hilomen *et al.* 2003). Hilomen *et al.* (2003) reported that of the 17 species dominating catches during their study, 11 were exploited below 10 cm and 14 were caught before the onset of first maturity. Other indicators of overfishing include high yield-to-biomass ratios (above 4.0) and catch per unit area (15-20 t/km^2)

Table 5. Estimates of demersal stock density in San Miguel Bay based on trawl survey data collected in 1947-2002 (adapted from Pauly 1982 and Cinco *et al.* 1995).

Year/Period	Stock Density (t/km^2)	Relative Stock Density (%)[a]	Source
1947	10.60	100.0	Warfel and Manacop (1950)
1957-1958	5.20	49.1	Pauly (1982)
1967	3.91	36.9	Pauly (1982)
1977	3.49	32.9	Pauly (1982)
1979	1.84	17.4	Pauly (1982)
1980	1.89	17.8	Pauly (1982)
1980-1981	2.13	20.1	Vakily (1982)
1992-1993	1.96	18.5	Cinco *et al.* (1995)
2001-2002	0.18	1.7	Hilomen *et al.* (2003)

[a] Using 1947 as base year.

since the early 1980s (Pauly 1982; Cinco *et al.* 1995; Hilomen *et al.* 2003).

The heavy fishing pressure has resulted in substantive changes in the composition of the catches and resources (Table 6). The following trends, reflective of both recruitment and ecosystem overfishing, are evident from available studies: (1) disappearance or greatly reduced number of sharks and rays (and other large, long-lived species), as well as *Otolithes ruber* (formerly dominant in trawl catches); (2) increased squid (Loliginidae) abundance; (3) increased shrimp abundance relative to fish biomass; and (4) increased abundance of cardinal (Apogonidae) and puffer (Tetraodontidae) fishes. Similar trends are evident elsewhere in the world and accepted as symptoms of biological overfishing.

Overfishing, thus, is a serious problem in San Miguel Bay. Silvestre (1996) noted that such overfishing leads to low catch rates and fishing incomes. Most of the fishers in the 79 coastal villages have incomes below the poverty threshold (about US$140 / month in 1992-1993), but stay in fishing given limited alternative livelihood opportunities. Moreover, they keep fishing as their incomes are above the opportunity wage prevailing in the area (about US$40 / month in 1992-1993). The evident biological and economic overfishing conditions in the San Miguel Bay fisheries persist amidst issues of high population growth, depressed rural conditions, habitat degradation, poor infrastructure, limited financial and organizational capabilities, lack of stakeholder participation in management, and institutional inadequacies.

Key Issues and Opportunities

A host of ecological, economic, social and institutional issues impact the fisheries in San Miguel Bay. Details of these issues are given in the various assessments noted above, and corresponding strategies and actions to resolve or mitigate them are given, among others, in Smith *et al.* (1983); PMO / FSP / DA-SMBMC-ICLARM (1995); Silvestre *et al.* (1995a); and Hilomen *et*

Table 6. Changes in relative abundance of various families/groups in trawl survey catches in San Miguel Bay from the late 1940s to the early 2000s with increasing fishing pressure and technological innovations (adapted from Silvestre *et al.* 1995b based on trawl survey data given in Warfel and Manacop 1950; Vakily 1982; Cinco *et al.* 1995; and Hilomen *et al.* 2003).

Family/Group	Observed Change in Relative Abundance	Probable Cause
Sharks and rays	Massive decrease	Recruitment overfishing
Cephalopods	Relative increase	Reduced predation
Penaeid shrimps	Relative increase	Reduced predation
Pristidae	Disappearance	Recruitment overfishing
"Trash" fish		
Low-value species (e.g., Gobiidae)	Relative increase	Species replacement, reduced predation
Juveniles of high-value species	Relative increase	Growth overfishing
Leiognathidae	Massive decrease	No straightforward explanation
Tetraodontidae, Apogonidae	Relative increase	Species replacement
Sphyraenidae, Drepanidae and Synodontidae	Relative decrease	Recruitment overfishing
Engraulidae, Clupeidae, Trichiuridae, Carangidae and Scombridae	Relative increase	Technological (higher trawl opening and speed)
Otolithes ruber	Massive decrease	Recruitment overfishing

al. (2003). The key fisheries management issues and opportunities are outlined below.

Overfishing

As previously noted, the issue of overfishing is serious and evidently requires substantive reduction of fishing capacity. This will need, among others: (1) replacement of current open access system with effective rights-based licensing schemes; (2) redirection of fishing capacity through alternative livelihood and investment opportunities; (3) wider use of marine protected areas; and (4) regulation of the mix of fishing gears used in the bay (towards more selective nontrawl sections of fisheries).

Capture of undersized fishes

The capture of small, immature fishes is substantial particularly in the trawl, scissor net and filter net operations. The issue requires technological measures (such as control of appropriate mix of gears and mesh sizes used) and regulation of temporal and spatial disposition of fishing gears. Wider use of spatial (gear) zonation schemes incorporating marine protected areas and seasonal closures need attention.

Gear conflicts

Competition for resources and gear conflicts have intensified with increased fishing pressure, particularly between the trawl and nontrawl sections of fisheries. While the intrusion of commercial trawlers into municipal waters has substantially abated, rapid expansion of the number of municipal trawlers has increased competition and conflict among fishers. Innovative management toward the right mix of gears and spatial (gear) zonation schemes are needed to reduce conflicts and enhance social stability.

Destructive fishing methods

Blast and cyanide fishing persists in certain parts of the bay despite being illegal and acknowledged to harm both resources and coral reef habitats. The problem requires, among others, enhancement of monitoring and enforcement, alternative livelihood schemes, public awareness and education, and participation of fishers and other stakeholders in management.

Degradation of coastal habitats

Soil erosion in the catchments and siltation of the bay (with a silt load of 15.5 million m^3/year) impact coastal water quality and habitats such as reefs. Fecal coliform levels are above national standards in localized areas off Mercedes and the outfall of the Bicol River into the bay. Reef areas are mostly in fair to good condition, but are impacted by siltation, destructive fishing methods, and excessive fishing and gleaning in the tidal flats. The mangrove area is only about 50% of those during the late 1950s, and present stands are under heavy pressure from harvesting for firewood and conversion to other land uses such as fishponds. Destruction of mangroves aggravates the siltation problem in coastal waters, as well as impacts on adjacent reefs. Measures in response to these coastal degradation issues are given in Silvestre (1996) and PMO / FSP / DA-SMBMC-ICLARM (1995), and include stabilization of critical uplands and mangrove and upland reforestation.

Post-harvest losses

Losses in the value of fish catches are substantial particularly in isolated eastern parts of the bay. Improved post-harvest handling requires attention, together with improvement of rural road infrastructure and of silted ports and jetties, and ice plant rehabilitation.

Inadequate participation of stakeholders

Enhancing the awareness and participation of fishers and other stakeholders is necessary for better and more cost-effective management of fisheries. Improved transparency and institutionalized participation of stakeholders in key aspects of fisheries management are needed. Enhancement of fishers' organizations, education and awareness programs, constituency-building for fisheries reforms, community organizing, and improved extension, training and credit support activities require attention.

Research inadequacies

Effective management systems have to be supported by appropriate research and information. The "feedback loop" between research and management decision / action processes requires attention. Development of local research institutions to provide cost-effective, timely and relevant inputs to the management process is needed. While a substantive number of assessments exist for the bay, these require extension outside its limits given the evident resources and fisheries dynamics. Site-specific research is needed, among others, in the following areas: recruitment dynamics; size and siting of marine protected areas; resource enhancement and habitat rehabilitation; selective fishing and zonation schemes; appropriate fisheries management reference system; ecosystem modeling; and policy and institutional research.

Institutional inadequacies

Many of the issues discussed above persist due to the inability of existing institutions to resolve or mitigate them. Upgrading of the policy, regulatory and administrative system for managing fisheries in the bay needs attention. Consolidation of fisheries authority and resources across municipalities (and national line agencies) is needed to allow for integrated, effective and cost-efficient fisheries management. Such consolidation will have to include areas outside the bay, given the spatial distribution of both resources and fishing effort. Upgrading of the financial, technical and humanpower capabilities of organizations involved with fisheries management (incorporating participation and cost-sharing by stakeholders) also requires attention.

Overall, it is noted that the host of issues requires an integrated program of actions on a broad front. It is emphasized that the record in San Miguel Bay is "quite lacking in implementation" despite substantial studies documenting issues and appropriate management directions. Moreover, ultimate solutions to issues impacting fisheries depend on how progress is made in addressing national issues related to poverty, wider economic development, social justice, population and overall national development.

References

Bailey, C., Editor. 1982a. Small-scale fisheries of San Miguel Bay, Philippines: Occupational and geographic mobility. ICLARM Tech. Rep. 10, 57 p.

Bailey, C., Editor. 1982b. Small-scale fisheries of San Miguel Bay, Philippines: Social aspects of production and marketing. ICLARM Tech. Rep. 9, 107 p.

Cinco, E. and G.T. Silvestre. 1995. Population parameters and exploitation ratios of fishes caught in San Miguel Bay, Philippines. *In* G. Silvestre, C. Luna and J. Padilla (eds.) Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1992-1993). ICLARM Tech. Rep. 47 (CD-ROM).

Cinco, E., J. Diaz, R. Gatchalian and G. Silvestre. 1995. Results of the San Miguel Bay trawl survey. *In* G. Silvestre, C. Luna and J. Padilla (eds.). Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1992-1993). ICLARM Tech. Rep. 47 (CD-ROM).

FIDC-NRMC (Fishery Industry Development Council and Natural Resources Management Center). 1980. Assessment of Philippine fishery wealth (marine sector): A Delphi approach. FIDC-NRMC, Quezon City, Philippines. (Unpublished).

Fox, P. 1986. A manual of rapid appraisal techniques for Philippine coastal fisheries. Research Division, Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 43 p.

Hilomen, V.V., J. Fragillano, F. Torres Jr., C. Luna, J. Jovellana and R. Crusio. 2003. Post-RSA of San Miguel Bay: Fisheries component. Project Report submitted to the Fisheries Resource Management Project, Department of Agriculture. SEAMEO Regional Center for Graduate Study and Research in Agriculture, Laguna, Philippines.

Legasto, R.M., C.M. Del Mundo and K.E. Carpenter. 1975. On the hydro-biological and socio-economic surveys of San Miguel Bay for the proposed fish nurseries/reservations. Philipp. J. Fish. 13(2): 205-246.

Pauly, D. 1982. History and present status of the fisheries, p. 95-124. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: Biology and stock assessment. ICLARM Tech. Rep. 7, 124 p.

Pauly, D. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: Biology and stock assessment. ICLARM Tech. Rep. 7, 124 p.

PMO/FSP/DA-SMBMC-ICLARM (Program Management Office/Fisheries Sector Program/ Department of Agriculture - San Miguel Bay Management Council – International Center for Living Aquatic Resources Management). 1995. The San Miguel Bay integrated coastal fisheries management plan. PMO/FSP/DA, Quezon City; SMBMC, Camarines Sur; and ICLARM, Makati City, Philippines. ICLARM Tech Rep. 51 (CD-ROM).

Silvestre, G.T. 1996. Integrated management of coastal fisheries: Lessons from initiatives in San Miguel Bay, Philippines. ICLARM, Makati City, Philippines. 13 p.

Silvestre, G.T., C.Z. Luna and H. Montalvo, Editors. 1992. The coastal environmental profile of San Miguel Bay, Philippines. ICLARM Tech. Rep. 50 (CD-ROM).

Silvestre, G.T., C.Z. Luna and J. Padilla, Editors. 1995a. Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1992-1993). ICLARM Tech. Rep. 47 (CD-ROM).

Silvestre, G.T., E. Cinco, R. Gatchalian and J. Diaz. 1995b. Catch and effort in the San Miguel Bay fisheries. *In* G. Silvestre, C. Luna and J. Padilla (eds.) Multidisciplinary assessment of the fisheries in San Miguel Bay, Philippines (1992-1993). ICLARM Tech. Rep. 47 (CD-ROM).

Simpson, A. 1978. Report of the BFAR/SCS Workshop on the Fishery Resources of the Pacific Coast of the Philippines. South China Sea Fisheries Development and Coordination Program, Manila. SCS/GEN/78, 48 p.

Smith, I.R. and A.N. Mines, Editors. 1982. Small-scale fisheries of San Miguel Bay, Philippines: Economics of production and marketing. ICLARM Tech. Rep. 8, 143 p.

Smith, I.R. and O. Salon. 1987. Economic effects of overfishing in San Miguel Bay, Philippines, p. 196-204. *In* IPFC Proceedings of the Symposium on the Exploitation and Management of Marine Fishery Resources in Southeast Asia, 16-17 February 1987, Darwin, Australia. Indo-Pacific Fisheries Commission (IPFC) and Regional Office for Asia and the Pacific (RAPA), FAO, Bangkok, Thailand. RAPA Rep. 10, 552 p.

Smith, I.R., D. Pauly and A.N. Mines. 1983. Small-scale fisheries of San Miguel Bay, Philippines: Options for management and research. ICLARM Tech. Rep. 11, 80 p.

Umali, A.F. 1937. The fishery industries of San Miguel Bay. Philipp. J. Sci. 63(2): 227-258.

Vakily, J.M. 1982. Catch and effort in the trawl fishery, p. 65-94. *In* D. Pauly and A.N. Mines (eds.) Small-scale fisheries of San Miguel Bay, Philippines: Biology and stock assessment. ICLARM Tech. Rep. 7, 124 p.

Warfel, H.E. and P.R. Manacop. 1950. Otter trawl explorations in Philippine waters. United States Fish and Wildlife Service, Department of the Interior, Washington, DC, USA. Res. Rep. 25, 49 p.

Bioeconomic Modeling of Fisheries Policies in Lamon Bay, Philippines[1, 2]

MARIBEC A. CAMPOS
SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA)
College, Los Baños, Laguna 4031
Philippines

Introduction

Lamon Bay (Figure 1) is one of the most important fishing grounds in the Philippines. In spite of this, most fishers in the area live in poverty, and their plight is getting worse. Fish catch is declining by 13.5% a year, more than double the decline experienced elsewhere in the country. Current fisheries policies for the area have failed to improve the situation but no research has been done to find out why. Are the policies poorly designed? Or have they not been adequately enforced?

This paper attempts to fill this information gap about the reasons for policy failure. Drawing on data from secondary sources and an original survey, it uses a bioeconomic model to simulate the effects of changes in the enforcement levels of three current policies: ban on electric shiners, fish cage regulation and regulation of both electric shiners and fish cages. Investments of the government on different levels of enforcement were assessed using benefit-cost analysis (BCA).

Objectives

The study used bioeconomic modeling to assess fisheries policies that can be implemented in Lamon Bay. The specific objectives of this study were to:

1. evaluate some of the existing local fisheries policies;
2. determine the major factors that influence trends in fishery catch under different fisheries policies, using a bioeconomic model; and
3. recommend further enhancements, where necessary, to the fisheries policies considered.

Bioeconomic Model

Both biological and economic units are included in models of fishery economics. The biological unit consists of a growth function relating natural growth (reproduction plus individual growth minus mortality) to the fish population size or fish stock. Such relationship is the logistic biological growth function:

$$G = G(X);\ G(X) >/< 0 \text{ for } X >/< K,\ \partial G/\partial X >/< 0 \tag{1}$$

For X >/< maximum sustainable yield, $\partial^2 G/\partial X^2 < 0$ throughout

Where:
G is natural growth measured in weight of biomass;
X is fish stock also measured in weight of biomass;
and K is natural equilibrium stock or carrying capacity of the environment.

The economic unit consists of the relationship between output (catch) and inputs (fishing effort) known as the production function:

$$Y = j\,(E);\ \partial j/\partial E > 0,\ \partial^2 j/\partial E^2 < 0 \text{ for } X = \bar{x} \tag{2}$$

This equation implies that, for any given X, the larger the effort (E), the greater the catch (Y). Conversely, for any given E, the larger the fish stock, the greater the catch:

---

[1] This paper can be cited as follows: CAMPOS, M.A. 2004. Bioeconomic modeling of fisheries policies in Lamon Bay, Philippines, p. 300-304. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] This paper is based on a research project funded by the Economy and Environment Programme for Southeast Asia, and implemented by the Southeast Asian Ministers of Education Organization Regional Center for Graduate Study and Research in Agriculture (SEAMEO-SEARCA).

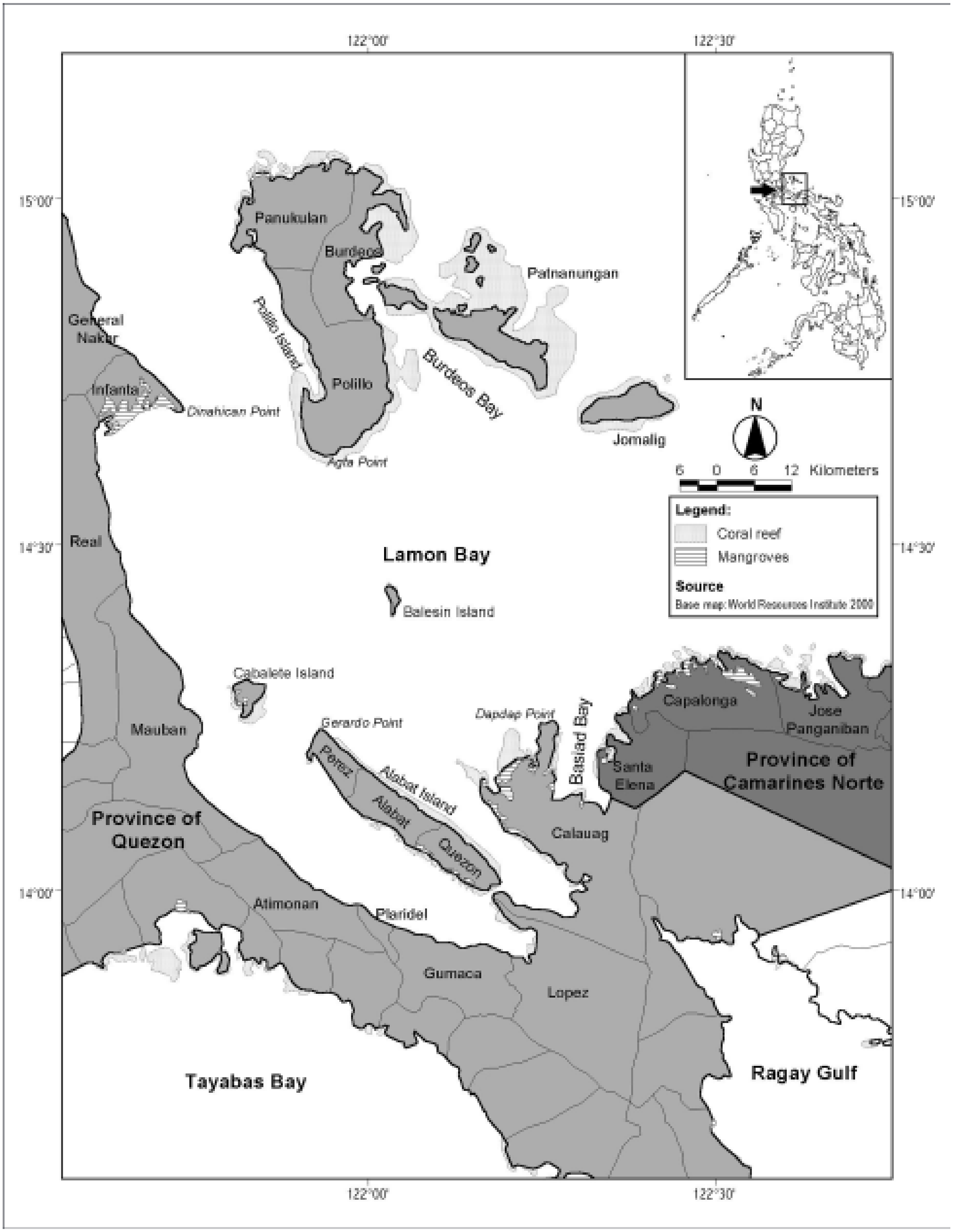


Figure 1. Lamon Bay, Philippines.

$$Y = r(X);\ \partial r/\partial X > 0,\ \partial^2 r/\partial X^2 < 0,\ \text{for } E = \bar{E} \quad (3)$$

If we combine equations (2) and (3), the fishery production function is:

$$Y = F(E,X);\ \partial F/\partial E > 0,\ \partial^2 F/\partial X^2 > 0,\ \partial F/\partial E < 0,\ \partial^2 F/\partial X^2 < 0, \quad (4)$$

The fish stock (X) in the fishery production function (5) can be assumed to be constant ($X = \bar{X}$) and eliminated from the equation as an explanatory factor of variations in catch, hence,

$$Y = f\,(E,X) \quad (5)$$

Fishing effort is itself an output of various fishing inputs or it is a composite input that can be broken down into its component elements such as capital and labor. Capital may be represented by the numbers of boats and fishing gear while labor can be represented by population and number of fishers. The fishers or fishing units produce effort and each fisher's catch depends not only on his own effort but also on the effort applied on the given fish stock by fellow fishers.

Similarly, an increase in fish prices, without any change in costs, would induce entry into the fishery until all profits are dissipated. Changes in fish prices occur as a result of shifts in the supply of or demand for fish. With a given demand, a poor catch would lead to an increase in price and a higher catch to a fall in price. With a given supply, increasing demand (due to population growth or increasing incomes) would lead to increasing fish prices. Catch rises in the short run but falls in the long run if the fishery is biologically overexploited. Daily or seasonal fluctuations of catches or prices may or may not affect the equilibrium level of effort depending on the level of exit and re-entry (including the availability of alternative employment for labor and capital).

Combining the above elements will produce catching power so that

$$E = j(POP, FMEN, FTECH, PR) \quad (6)$$

Where:
E = is the fishing effort which can be in the form of labor and capital inputs;
POP = population in the fishing community;
FMEN = total number of sustenance fishers affected by a particular fisheries policy; specified as: MFGAT (total number of sustenance fishers affected by milkfish fry gatherers), ESHINER (total number of sustenance fishers affected by users of electric shiners) and FCAGE (total number of sustenance fishers affected by fish cages); and
FTECH = level of fishing technology employed by the fishers. In order to increase catch, they increase the number of boats.

Specified as HNLINE (hook and line), MHOOK (multiple hooks), GNET (gillnet):

PR = average price of a fish species in P/kg

Inputs to the bioeconomic model were obtained through 10-month daily monitoring of fisher-respondents from the coastal municipalities of Infanta, Real and Polillo, Quezon province. The aforementioned model was run for the three different policy scenarios. Cross section data on E, POP, FMEN, PR and FTECH taken from the daily monitoring survey were used in the model.

The hypothesized values of the partials are:

An increase in the population of the Lamon Bay watershed will increase fishing effort since the main livelihood of the people in the coastal areas is fishing. Fishing is an open access livelihood which makes it the primary source of income in the area. Aside from this, fish is the major source of protein of the coastal villages.

$\partial j/\partial FMEN > 0$ An increase in the number of fishers will increase the rate of resource extraction in terms of human resource.

$\partial j/\partial FTECH > 0$ An increase in the number of boats will directly increase fishing effort.

$\partial j/\partial PR > 0$ An increase in the price of fish will increase the rate of resource extraction.

In an overexploited natural resource system, continuous exertion of efforts in the form of an increase in population, number of sustenance fishers, number of boats in operation and unregulated fishing would likely result in a declining output. Increasing prices, on the other hand, would enable the fishers to double their effort to catch more fish. However, given the overexploited status of the resource, the fisheries would collapse.

Results and Discussion

General assessment of yield equations

All equations gave the characteristics of a good fit as evidenced by the consistency signs of coefficients, statistical significance of coefficients, high values and high coefficient of determination, R^2, except for banning of fish cages.

The results of the log-linear model for fish catch of municipal fishing gears using present or existing scenario where regulations had been on hand but with very minimal violators apprehended like 23 electric shiners in the whole Lamon Bay. The yield equation for mackerels for instance has an R^2 of .953 which implies that 95 percent of the variation in mackerel yield is explained by all explanatory variables included in the model. The high F-value (25.84) connotes that the random impact of unspecified variables is less, therefore, the derivation of the curve from straight line is likewise less. In the case of other fish caught in Lamon Bay, more or less the same independent variables appear to affect decline in productivity. The presence of the three fish cages is not significant, meaning that there are so few that they do not affect yield of other fish species like mackerel, barracuda, yellowbelly threadfin bream, thumbprint emperor, grouper, flame-colored snapper, goatfish, sardines and bigeye trevally. Milkfish is cultured in these fish cages. The sardines equation gave the best fit of data with a high R^2 (.972) and F value (41.98).

The results of the second model are a regulation scenario for banning of electric shiners. The R^2 are all significant and high. As in the first model, the presence of fish cages remains to be insignificant. The best fit is seen in yield of yellowbelly threadfin bream with F-value of 38.74.

For regulation of fish cages, the log-linear results are all insignificant, with very low R^2 ranging from .159 to .477. This implies that there are more unexplained variables that have been unspecified in the equation. The fish cages in the project site have no impact on fish yield in the bay. Besides, they are located in inland waters and involve culture of milkfish as compared to the other municipal gears which engage in capture fishery.

Seasonal regulation of milkfish fry gatherers shows that R^2 values are high and significant, ranging from .729 to .987. Only the presence of fish cages remains insignificant.

The combination of regulating fish cages and banning electric shiners shows a very high coefficient of determination, R^2, ranging from .829 to .952. The effect of fish cages is also insignificant. All significant values are at 1% level of probability.

Results show that fishing effort of milkfish fry gatherers, electric shiners, fish cages, hook and line, multiple hooks and gillnets is negatively related to yields of mackerel, barracuda, yellowbelly threadfin bream, thumbprint emperor, grouper, flame-colored snapper, goatfish, sardines and bigeye trevally, reflecting the fact that Lamon Bay is overexploited. An increase in the level of fishing effort did not increase yield in all fishing gears, but instead resulted in a decline in fish catch. The explanatory variable found to have significant effects on fish yield were the number of boats in operation and price of fish. The marginal product of each fishing gear with respect to a particular fish species was also determined by the model. The marginal product was negative in all cases, meaning one additional unit of boat results to a decrease in the average catch per boat. This is justified by historical data showing a drop in catch per unit effort (CPUE) from 1965, 11.86 kg for hook and line, and 52 kg for gillnet, to 2.27 kg in hook and line, and 9.52 kg for gillnet in 2001. The model depicted positive coefficients of prices, which were all significant. This implies that increase in the prices of fish caught motivates the fishers to increase their catch. All models for the different scenarios gave the characteristics of a good fit as evidenced by the consistent sign of the coefficients, statistical significance of coefficients, high values and high coefficient of determination, R^2, except for banning of fish cages. This is to due to the small number of fish cages sited at the time of the study, that is, only three units.

Benefit-cost analysis

The yield results of the bioeconomic model were run for BCA of income and expenditures estimates taken from the survey of 450 fishing households (Table 1). The BCA showed that if there are no regulations imposed, the net present value (NPV) is negative (-P14.6 million). The losses could be attributed to declining fish catch in the bay. Accordingly, the benefit-cost ratio (BCR) is only 0.85 while the internal rate of return (IRR) is less than zero. With regulation, three policy options were tested: with ban on electric shiners, fish cage regulation and regulation of both electric shiners and fish cages. In banning electric shiners, if the local government will go on allotting a meager amount for the implementation and monitoring of fisheries laws, fish catch will continue to decline in the area. This scenario of low level of enforcement will result in a negative net benefit of P10.8 million, a BCR of .89 and a negative IRR. In contrast, high level of enforcement or provision of additional funds in policy implementation and monitoring will yield positive gains. The NPV for this condition is P1.4 million. The BCR is 1.01 and the IRR, 61.73%. The results showed that imposition of a fish cage regulation is not as effective as banning shiners. With the current level of investment where there is low enforcement, there is

Table 1. NPV, BCR and IRR by scenario/policy option, 2002-2006.

Scenario/Policy Option	NPV	BCR	IRR (%)
No regulation	(14,565,542.83)	0.85	<0
Shiner ban			
• Current or low level of investment/resources	(10,838,875.81)	0.89	<0
• With additional or high investment	1,422,314.36	1.01	61.73
Fish cage regulation			
• Current or low level of investment/resources	(14,102,989.61)	0.85	<0
• With additional or high investment	(1,207,723.15)	0.99	<0
Shiner and fish cage ban			
• Current or low level of investment	(10,356,433.41)	0.89	<0
• With additional or high investment	2,294,793.92	1.02	93.29

hardly any difference in NPV, BCR and IRR compared to the results obtained in the no regulation scenario. Pouring in additional funds or high enforcement improved NPV (P1.2 million) and BCR (1). An imposition of both controls (ban on shiners and fish cage regulation) yielded best results. Nevertheless, with the current investment levels or low enforcement, outcomes of NPV (-P10.4 million), BCR (0.89) and IRR (less than 0%) are still not favorable. This is because the increase in fish catch brought about by implementation of law is quite small to offset the diminishing productivity of the bay. The provision of additional resources or high enforcement, however, generated positive results. The NPV amounted to P2.3 million; BCR, 1.02; and IRR, 93.29%. High level of enforcement or increasing government investments on monitoring and implementation of the regulations support the hypothesis that the policies will increase incomes of the municipal fishers.

The report assesses the effects of enforcing current fisheries policies more stringently. It finds that a substantial investment (P614,000 per year) would be required to ensure compliance with regulations and that the benefits of achieving high levels of compliance would exceed costs by only a tiny margin. The situation would be transformed into one in which large and perhaps increasing number of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting fewer fish. Because the bay is already overfished, CPUE and marginal productivity would decrease. Any additional fishing effort in the bay will result in a decrease in the average catch of all fishers. Enforcement of current policies will not address the underlying problems of open access and severe overfishing which is the main problem.

Policy Implications

One policy to deal with the problems of open access and overfishing is to set a limit on the total number of fish that can be caught and divide this quota among Lamon Bay's fishers. Over time, the total allowable catch might be reduced. (The easiest way to make the initial reductions would be to revoke the permits of fishers who contravene fishing regulations, e.g., regarding permissible catch size or seasons). To allow flexibility, the quotas allocated to individual fishers might be tradeable. This system of individual tradeable quotas or permits has been very successful in New Zealand.

The number of fishers in a given locality is an important element, giving rise to the community-based management approach of coastal resources. If communities are allowed to control resources, then they are able to prevent encroachment or even control the entry of legal or illegal fishers. They may even be empowered to set the limit on the number of fish catch that can be allowed. This would strengthen implementation of Republic Act 8550 not only in Lamon Bay, but also in other coastal areas.

The typical Lamon Bay fisher is below the poverty level, has almost no secondary source of income and has household members willing but unable to obtain work. Efforts to reduce overfishing in the bay must therefore be complemented with measures to promote alternative sustainable livelihoods.

Fisheries Management in Honda Bay[1]

BENJAMIN J. GONZALES
Fisheries Resource Management Project
Department of Agriculture – Bureau of Fisheries and Aquatic Resources
Estuar Building, Quezon Avenue, Quezon City
Philippines

Introduction

Honda Bay is one of the three bays surrounding Puerto Princesa City, the capital of Palawan Province on the northwestern portion of the Philippines (Figure 1). The city has 66 barangays of which 18 are found along Honda Bay, which has an area of about 28,000 ha and a coastal population of about 50,000. Extensive shallow coral reef platforms, seagrass beds, sand cays and mangrove swamps surround the bay and its islands forming part of the nearshore ecological system of the larger Sulu Sea marine ecosystem (Sandalo 1994). Eight main rivers drain into the bay: Babuyan, Bacungan, Langogan, Magarwak, Tanabag, Tandayak, Tarabanan and Ulanguan. Some of these rivers carry clean waters, while others carry some industrial wastes (Gonzales 2003).

The semi-enclosed waters of Honda Bay are economically and ecologically important, with numerous marine species being nurtured in its lagoons and estuaries. In the early 1980s, coastal residents of the bay still enjoyed bountiful coastal resources. Average fish catch per fishing trip of fishers was 36.5 kg in 1985. Coral reefs, seagrass beds and mangroves were of good quality (Sandalo 1994). Honda Bay provides a source of livelihood and supports tourism, through its many small islands. Compared to other bays across the country, some critical littoral ecological habitats of Honda Bay are still in fair condition with relatively thick mangrove forest, diverse seaweed and seagrass beds (Roleda *et al.* 2001).

Legal Framework for Fisheries Management Planning

The main legal and institutional framework that ensures conservation, protection and sustainable management of the fishery resources of the bay are the Philippine Fisheries Code of 1998 and the Strategic Environmental Plan (SEP), Republic Act 7611. The SEP serves as guide to local government units (LGUs) and other concerned agencies in the formulation and implementation of plans, projects and programs affecting the environment of Palawan. Puerto Princesa City has passed 27 coastal resource management (CRM)-related city and barangay ordinances from 1998 to 2002. The bay also has several city government offices, national government agencies (NGAs), nongovernment organizations (NGOs), academe, and fishers' and other groups who assist in implementation of coastal and fisheries management (Table 1).

Moderately to Heavily Exploited Bay?

Due to its central location and growing urbanization and population in the area, Honda Bay is being subjected to increasing resource uses and conflicts, resulting in more potential for overexploitation. Fishers from other regions and municipalities migrate to Honda Bay for greater livelihood prospects. The estimated coastal population has increased from 12,500 in 1990 to 50,000 in 2000, with a growth rate of 3,750 persons per year. Like most other bays in the country, Honda Bay has also shown signs of fish resource deterioration. The bay was categorized as lightly fished with a density of 3 fishers km^{-1} in 1980 (Fox 1986), but in 2001, it became moderately to heavily fished with a 900% increase to some 26 fishers km^{-1} (Aliño *et al.* 2001a). Average fish catch per fishing trip declined from 36.5 kg in 1985 (Sandalo 1994) to 2 kg in 2000. The increase in catch in 2003 was true only in areas near a fish sanctuary (Figure 2).

In 2000, the potential demersal yield of Honda Bay was 3,430 $t \cdot year^{-1}$ while the demersal catch was

[1] This paper can be cited as follows: GONZALES, B.J. 2004. Fisheries management in Honda Bay, p. 305-311. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

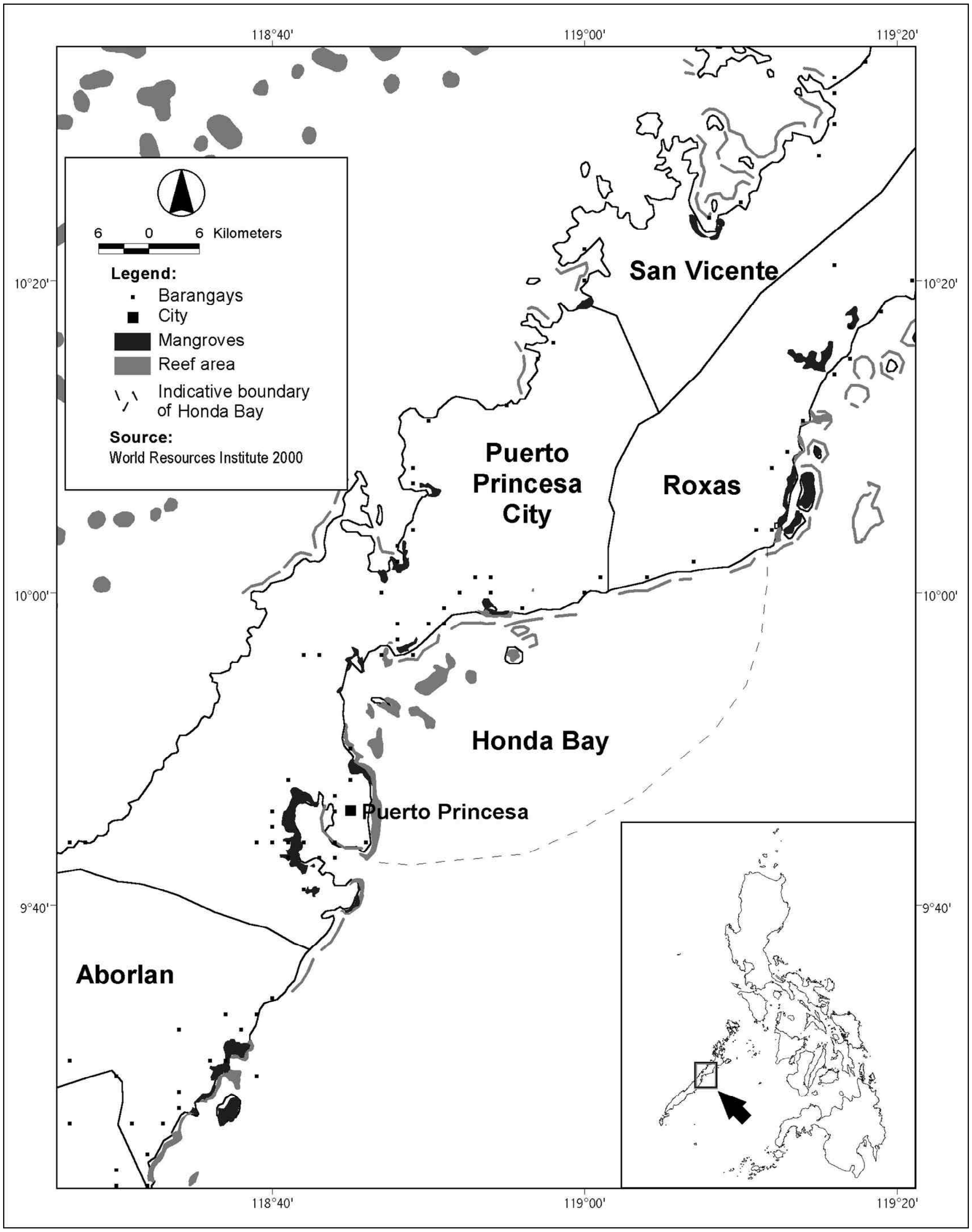


Figure 1. Honda Bay, Philippines.

8,781 t·year^{-1} (Luna *et al.* 2001). Annual baywide demersal catch exceeds harvestable potential yield. These circumstances suggest that the demersal fishes of Honda Bay are being overfished. Several fish species exhibit exploitation ratios beyond the optimum range and the economic value of faunal assemblages has been declining since 1980, which also indicates growth and recruitment overfishing. If these rates of harvesting continue, the Honda Bay fisheries is facing a disastrous fate.

The declining demersal fisheries call for management measures to reduce fishing effort. Recent anecdotal evidence suggests that there has been a decrease in illegal fishing activities, due in part to an incentive system implemented by the city for illegal fishers to convert to legal fishing gears. However, the fisheries are still in an open access state, with no clear licensing or limited access regime.

According to fishers in Honda Bay, their shellfish resources were bountiful in the 1970s until traders and divers from other parts of the country came to Palawan and harvested different kinds of commercial shellfishes. At present, fishers express apprehension regarding activities of encroaching fishers using compressor for fishing in Honda Bay.

Although Honda Bay is showing increased signs of fish resource deterioration, Luna *et al.* (2001) still categorized it as moderately exploited because of the low estimates of 17 fishing boats and 26 fishers per km^2 (Aliño *et al.* 2001a). The coral reef cover is of fair to good quality (Aliño *et al.* 2001b), and the reef fishes are moderate in terms of diversity, abundance and biomass (Nañola and Rodriguez 2001). The low numbersof fishers/fishing boats in the bay may indicate that they are using very efficient gears. Also, since many fishers are transient, it is likely that the density of boats and fishers was underestimated.

Table 1. List of various government agencies, NGOs and other groups who assist in implementation of coastal and fisheries management in Honda Bay.

- Anti-squatting Program
- Armed Forces of the Philippines Western Command
- *Bantay Puerto* Program
- barangay councils
- Barangay Fisheries and Aquatic Resource Management Councils (BFARMC)
- Barangay people's organizations
- City Environment and Natural Resources Office
- City satellite hospitals
- City Tourism
- Department of Agrarian Reform
- Department of Agriculture - Bureau of Fisheries and Aquatic Resources (DA-BFAR)
- Department of Environment and Natural Resources
- Environmental Legal Assistance Center
- Fisheries Resource Management Project, DA-BFAR
- Haribon Foundation - Palawan
- Irish Marine Development Corporation
- *Kilusan Ligtas Malaria*
- *Liga ng mga Barangay*
- National Irrigation Administration
- Office of the City Agriculturist
- Office of the City Health Officer
- Office of the City Mayor
- Office of the City Veterinarian
- Office of Social Welfare and Development
- Palawan Center for Appropriate Rural Technology
- Palawan Council for Sustainable Development staff
- Philippine Coast Guard
- Philippine Coconut Authority
- Philippine National Police Maritime Group
- Philippine Navy
- *Sangguniang Bayan/Panlungsod*
- State Polytechnic College of Palawan

Management Issues

Although plans for specific action mechanisms and implementation are included in the Honda Baywide Plan, actual implementation is limited. The management problems of coastal and fishery resources are compounded by conflicts between tourist boat operators' association and commercial resort owners, the presence of transient fishers and different interests of fishers regarding fishing rights.

Monitoring, control and surveillance need improvement. Coordination among the bay's stakeholders, including institutions, is improving, through the creation of sectoral committees in the city government. The Environmental and Natural Resources Sectoral Committee regularly convenes the agencies involved in CRM to discuss issues and concerns (Table 2). However, the Integrated CRM Network, which is under the committee, needs full support to assign a specific body to attend to specific issues (Figure 3).

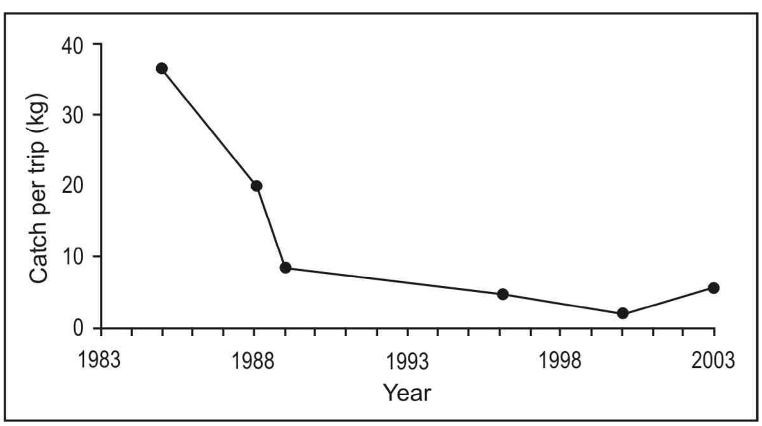


Figure 2. Average fish catch per trip in Honda Bay.

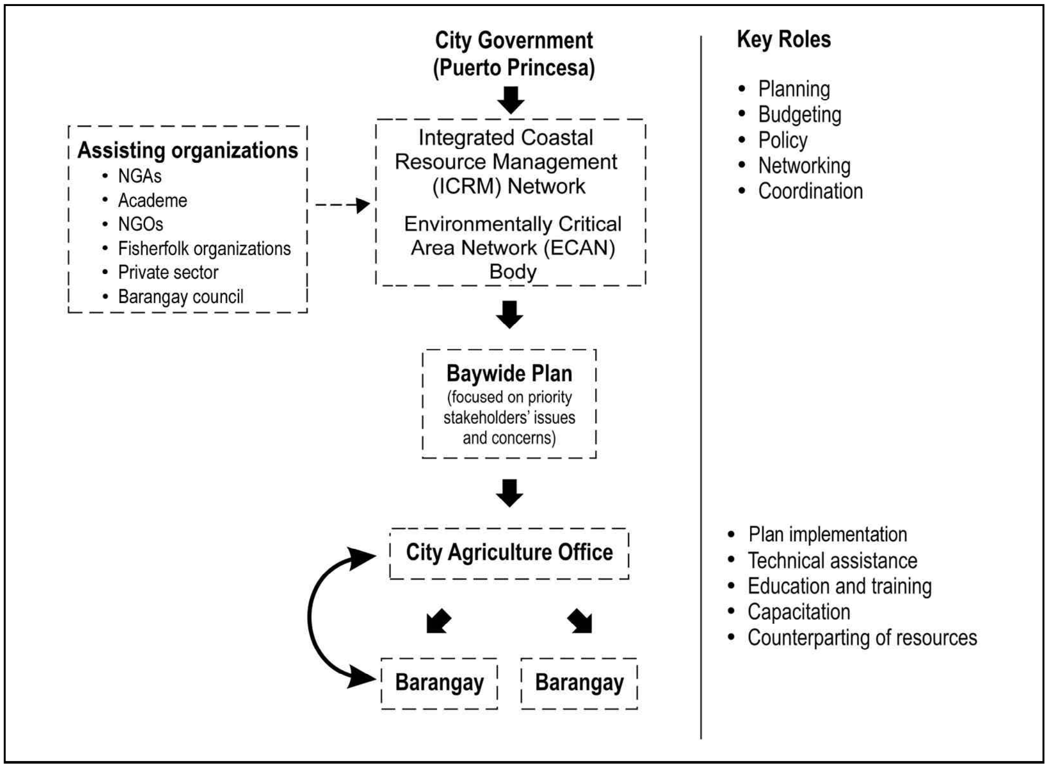


Figure 3. Key institutions, roles and planning process for the Honda Baywide plan.

Collaboration among NGOs and LGUs is apparent, e.g., the establishment of fish sanctuaries in the northern barangays of Honda Bay was a joint effort of the City Agriculture Office (CAO), the concerned barangay, Haribon Foundation-Palawan and Irish Marine Development Corporation. Proposed fish sanctuaries in the southern barangays are projects of CAO, the barangays and Environmental Legal Assistance Center. Although the City Council has yet to approve the establishment of the Fisheries Management Office, CAO is mandated to directly implement and coordinate the fishery management of Honda Bay. CAO needs sufficient personnel, training and skills to effectively manage the different aspects of fisheries.

The factors to achieve success in Honda Bay management are as follows:

- strong political will;
- continuous funding support from LGU and other sectors;
- continuous capability-building and monitoring;
- continuous advocacy and awareness activities;
- empowerment of coastal communities, with clear support;
- close coordination between NGOs and LGUs;
- existence of coastal law enforcement group both at baywide and barangay levels;
- establishment of additional marine sanctuaries; and
- application of fisheries licencing system.

Conclusion

Palawan is considered “the last frontier of natural resources in the country”. Various agencies, organizations and funding mechanisms are involved in the implementation of coastal and fisheries management in Honda Bay and the province as a whole. Several resource assessments have been conducted. National recognition has also been given, e.g., Puerto Princesa City was given the “Galing Pook” (excellent place) award for its coastal law enforcement activities.

Although the coral reef associated fishes, coral cover, diversity of seagrasses and seaweeds, and mangrove swamps of Honda Bay are categorized as being in fair and moderate condition, the bay is showing signs of deterioration of its fish resources and ecosystems. Annual baywide demersal catch exceeds harvestable potential yield, several fish species exhibit exploitation ratios beyond the optimum range and a decline in economic value of the overall faunal assemblage. The bay appears to be on the whole overexploited, albeit only moderately according to the literature. Surveys show that several coastal habitats in the bay are in moderate and fair conditions, while most fish resources are overexploited, indicative of

Table 2. Issues concerning Honda Bay management.

Fishing	Habitat Degradation	Water Quality	Socioeconomic/Cultural Issues	Institutional/ Legal Issues
Encroachment of commercial fishers within municipal waters of the bay Encroachment of transient fishing boats: modified *muro-ami* (*lintig*), motorized pushnet (*sudsud*), bagnet (*basnig*), daytime ringnet (*pangulong*) and night-time one (*likum-likom*)	Use of pesticides in upland affects livelihood of fishers, e.g., fry gathering and mariculture	No information database on rate of erosion and siltation in the bay	More training on river management for LGUs and communities More riverbank rehabilitation activities	Lack of secure land tenure
Declining/low fish catch:Sustenance fishers are forced to fish in areas farther from the shore or outside the bay due to apparent decrease in CPUE Declining volume of catch using the same gear and fishing area in unprotected areas	Low-level of community awareness on the importance of river management as an associated component of integrated coastal management	Low-level of community awareness on the importance of river management as an associated component of integrated coastal management	Need more training on waste management in coastal communities Lack of solid waste management infrastructure	Need for enhancement of law enforcement through additional personnel, equipment and trainings.
Overfishing: Pushnet (*sudsud*) identified as heavy competitor of sustenance crab and shrimp fishers (dipnet fishers) Influx of migrants, leading to further increasing pressure on resources	Almaciga and rattan gathering are still operating in some upland areas of the bay Slash and burn (*kaingin)* is still being practiced	Presence of mercury and cadmium in bay waters (Santos *et al*. 2001)	Integration of conservation and enhancement efforts for marine resources needs to be strengthened	BFARMCs exist, but still need more assistance in financial, technical and institutional aspects

Table 2 (cont.)

Table 2 (cont.)

Fishing	Habitat Degradation	Water Quality	Socioeconomic/Cultural Issues	Institutional/ Legal Issues
Illegal fishing Observance of isolated cases of blast fishing.	No resource and ecological survey in watersheds and rivers	Occasional occurrence of red tide (BFAR-Office, Office of Provincial Agriculture); more surveys must be conducted for verification	Lack of alternative livelihood Need to prepare people's organizations and associations to handle supplemental livelihood opportunities; stronger bonding and cooperation among members; strengthening of right attitude towards the success of the groups; enhancing spirit of cooperation rather than self-interest among members Although CAO - Fisheries Resource Management Project is initiating collaboration among associations and organizations through livelihood project trainings, a formal and institutionalized coordination system among them must be in place	The Fisheries Management Office under CAO needs approval of positions and corresponding budget.
Resource use conflicts between: tourism entities, tourism and fishers, and municipal and commercial fishers Unregulated gleaning of shellfishes Several municipalities in Palawan (e.g., San Vicente, Dumaran and Roxas) have prohibited the use of compressor fishing in their municipal waters, resulting in increase in number of compressor fishers in Honda Bay			Low community awareness on specific laws such as Fisheries Administrative Order 208, Republic Act 9147, RA 8550, Local Government Code and Water Code of the Philippines, and on some CRM best practices	

excessive fishing pressure. Thus, applications of licencing system and control of open access fisheries (e.g., marine sanctuaries) may help regulate the fishing effort. This indicates the need for further management interventions before it can be said that fisheries and habitats are being managed at sustainable levels. From a national perspective, this means that there is still a long way to go towards sustainable management of fisheries resources of Honda Bay and those of the country, which are in a worse condition than those of Palawan.

This suggests that there are still certain missing elements in fisheries management in the country which need to be explored. The correction of the "open access" system through licensing and limited access regimes is essential. We must also look at the larger fisheries ecosystem in management and broaden the scope of coastal management to include upland problems and population issues.

Bibliography

Aliño, L.L., E.B. Desabelle, R. Sariego, H. Palla, B. Montaño, R. Creador and G.T. Silvestre. 2001a. Results of fish stock assessment of Honda Bay, Puerto Princesa City, Palawan (2000-2001). Resource and ecological assessment of Honda Bay, Palawan. Vol. II. Chapter 5, Terminal Report. Fisheries Resource Management Project. 45 p.

Aliño, P.M., C. Nañola, M. Roleda and V.S. Ticson. 2001b. Highlights of the assessment of the coastal habitats in Honda Bay, Palawan (2000-2001). Resource and ecological assessment of Honda Bay, Palawan. Vol. II. Chapter 4, Terminal Report. Fisheries Resource Management Project. 11 p.

Arquiza, Y.D. 1999. Rhythm of the sea: Coastal environmental profile of San Vicente, Palawan. Coastal Resource Management Project, Cebu City, Philippines. 131 p.

Fox, P. 1986. A manual of rapid appraisal techniques for Philippine small pelagic fisheries. Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines. 43 p.

Gonzales, B.J. 2003. Puerto Princesa Bay and Honda Bay, Palawan: An ecological profile. Tech. Monogr. Ser. No. 8. Fisheries Resource Management Project, Department of Agriculture - Bureau of Fisheries and Aquatic Resources, Philippines.

ICLARM (International Center for Living Aquatic Resources Management). 1996. Resource and ecological assessment of Honda Bay, Palawan, Philippines. ICLARM, Makati City, Philippines.

Luna, L.Z., L.R. Garces and G.T. Silvestre. 2001. The resource and ecological assessment of Honda Bay, Palawan: Highlights and recommendations for resource management. Resource and ecological assessment of Honda Bay, Palawan. Vol. II. Chapter 1, Terminal Report. Fisheries Resource Management Project. 15 p.

Nañola, C. and E. Rodriguez. 2001. Reef fish communities of Honda Bay, Puerto Princesa City, Palawan. Resource and ecological assessment of Honda Bay, Puerto Princesa City, Palawan. Vol. II. Chapter 9, Terminal Report. Fisheries Resource Management Project. 11 p.

PIADP (Palawan Integrated Area Development Project). 1988. Socio-economic survey of coastal barangays along Honda Bay. Baseline resource assessment of Honda Bay. PIADP, Palawan, Philippines. 71 p.

Roleda, M., L. Alcantara, V.S. Ticson and B. Montaño. 2001. Spatial and temporal variation in the macrophyte community structure of Honda Bay, Puerto Princesa City, Palawan. Resource and ecological assessment of Honda Bay, Palawan. Vol. II. Chapter 6, Terminal Report. Fisheries Resource Management Project. 23 p.

Sandalo, R.M. 1994. Community-based coastal resources management: The Palawan experience, p. 165-181. *In* R.S. Pomeroy (ed.) Community management and common property of coastal fisheries in Asia and the Pacific: Concepts, methods and experiences. ICLARM Conf. Proc. 45, 189 p.

Santos, R.A.V., M.C. Celso, K.F. Santos, R. Creador and V.S. Ticson. 2001. Water quality assessment in Honda Bay, Puerto Princesa City, Palawan. Resource and ecological assessment of Honda Bay, Palawan. Vol. II. Chapter 3, Terminal Report. Fisheries Resource Management Project. 23 p.

Overexploitation in the Visayan Sea: Designing a Project Solution[1]

RUDOLF HERMES[2,3]
NYGIEL B. ARMADA[4]
REMIA A. APARRI[2]
ESTER C. ZARAGOZA[5]
UWE LOHMEYER[3]
[2]Visayan Sea Coastal Resources and Fisheries Management Project
Bureau of Fisheries and Aquatic Resources - Region 6
Muelle Loney St., Iloilo City, 5000
Philippines
[3]Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn
Germany
[4]Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo, 5023
Philippines
[5]Philippine Council for Aquatic and Marine Research and Development
Department of Science and Technology
Los Baños, Laguna,4030
Philippines

Introduction

The Visayan Sea, located between 11 and 12º N latitude and 123 and 124º E longitude, is an entirely neritic body of water measuring approximately 10,000 km^2 (Figure 1). It is among the top three fishing grounds of the country, producing more than 200,000 t of fish annually (BFAR 2000). About two-thirds comes from commercial fishing operations. In recent years, small-scale and commercial fish production has declined (Table 1). More than 18,000 fishing gears are operating in the area.

The Visayan Sea has been subjected to increasing fishing pressure during the past decades. From economically very lucrative demersal fisheries like the trawl, commercial fishing operations have shifted to even more efficient catching methods like the Danish seine and midwater trawl. The depletion of demersal fisheries has forced most fishing operators to shift to catching pelagic fishes. Small pelagics have thus become a logical focus for small and medium-scale fishing enterprises.

In 1998, there were reports indicating overfishing, widespread coastal habitat degradation and intense conflict over resources of the Visayan Sea. The reports, which were received by the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (BFAR) and the Department of Science and Technology – Philippine Council for Aquatic and Marine Research and Development (PCAMRD), were confirmed by results of stock assessment studies of small pelagic fish species (Armada 1999). Recognizing the considerable difficulty of implementing traditional fisheries management measures based on the establishment of maximum sustainable yield or catch quota in the different administrative subareas, a different approach was tried. The ecosystem-based management, with emphasis on the increasingly important role of local government units (LGUs) in managing their coastal resources, is the principle to be

[1]This paper can be cited as follows: HERMES, R., N.B. ARMADA, R.A. APARRI, E.C. ZARAGOZA and U. LOHMEYER. 2004. Overexploitation in the Visayan Sea: Designing a project solution, p. 312-317. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

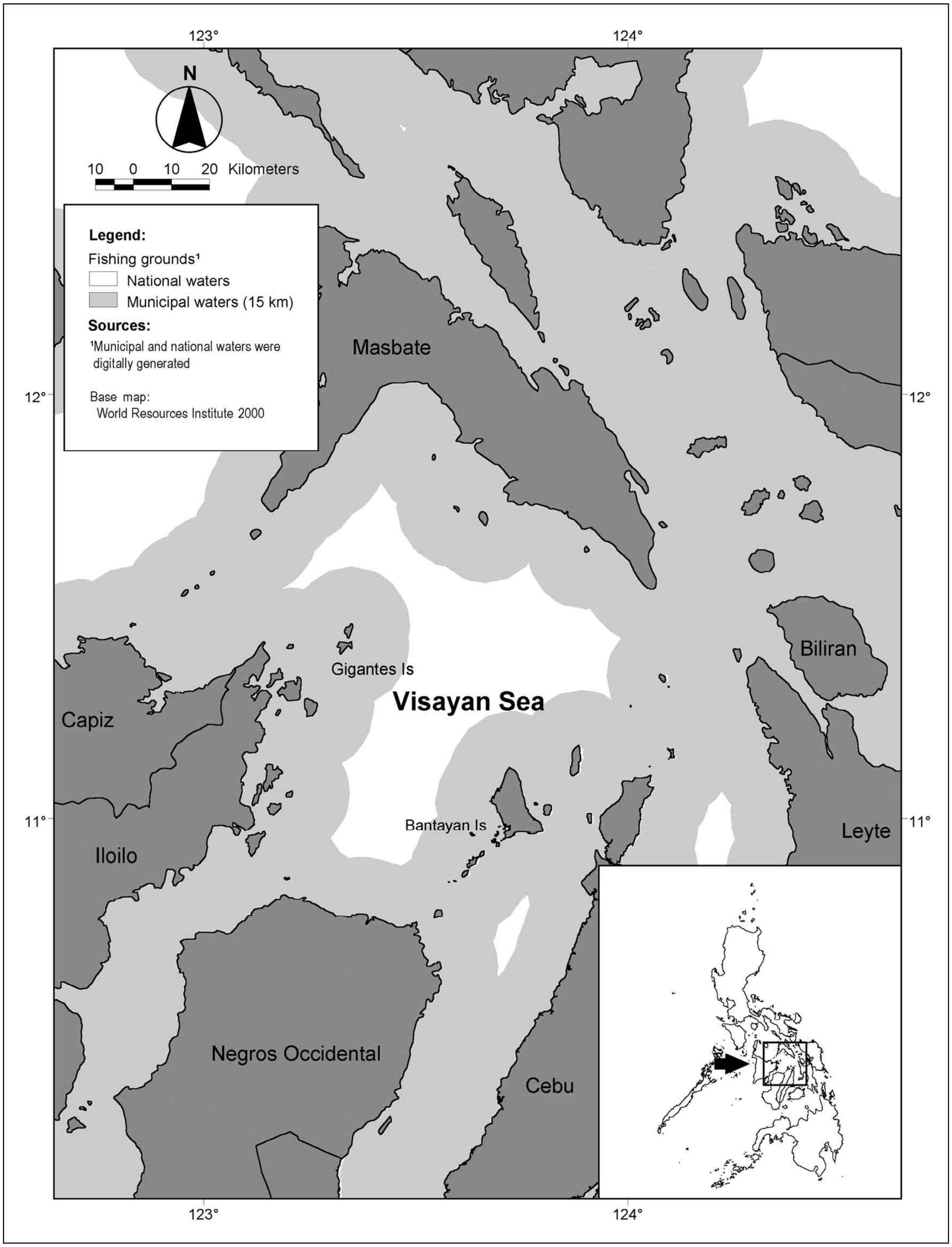


Figure 1. The Visayan Sea.

Table 1. Municipal and commercial fisheries production (t) in the Visayan Sea, 1992-1995 (BAS 1992-1995).

Year	Fisheries Production (t)		Total	
	Municipal	Commercial	Visayan Sea	Philippines
1992	92,583	165,256	257,839	1,659,553
1993	100,647	131,709	232,356	1,748,625
1994	89,695	134,537	224,232	1,672,293
1995	88,616	120,267	208,883	1,712,256

applied in the form of shared management across existing political and administrative boundaries.

Statistics point to a decreasing trend in volume of catch (Table 1) and this can be directly linked to overfishing, destruction of habitats, and over capitalization and nonlimitation of effort within the Visayan Sea. In 1995, the area ranked first in marine municipal fishery and third in commercial fishery production, contributing around 12% of the country's total marine catch.

Fishing Activities

Among commercial fishing gears, the purse seine, trawl and modified Danish seine are the most important. Traditional fishing gears, like bagnet, gillnet, liftnet, scissor net, filter net, hook-and-line, pots and traps, continue to be employed by fishers in the area. Recently, however, an increase in number of efficient fishing gears like the small-scale Danish seine and baby trawl has been observed. A number of fishing gears have undergone modifications from their original design and have evolved into species-specific fishing gears with adopted local names.

In 1997, about 78% of the total 1,157 commercial fishing boats counted in the different landing sites around Visayan Sea were either trawlers or Danish seiners. Pelagic fishing is seasonal, thus, the operation of ringnets and purse seines follows the pattern of seasonal occurrence and migration of major pelagic species. Fish catch of commercial boats is dominated by sardines (*Sardinella longiceps*, *Sardinella melanura*), Indian mackerel (*Rastrelliger kanagurta*) and bigeye scad (*Selar crumenophthalmus*).

Also in 1997, a total of 18,650 municipal fishing boats, which employed 21,510 fishing gears were operating in the area. Only 36% of these fishing boats were motorized. The most commonly used municipal fishing gears are the hook-and-line, squid jig, spear and different variations of gillnet. Municipal fishers are relatively flexible in their preference for catching either pelagic or demersal species. It is not uncommon for a sustenance fisher to have different gears to catch different species, depending on the season.

Resource Use Issues

The coastline of the Visayan Sea is shared by 22 municipalities, belonging to 4 island provinces (Masbate, Iloilo, Negros Occidental and Cebu) in 3 administrative regions of the country (Regions 5, 6 and 7). The Local Government Code of 1991 and the Fisheries Code of 1998 delegate the management of aquatic resources within the 15-km zone from the shoreline to LGUs or municipalities. However, intermunicipal coordination is weak and mechanisms for interregional resource management have not yet been established. The connectivity of the marine environment, prevailing current systems and fish recruitment patterns make it imperative that the resources of the Visayan Sea be managed as one relatively large marine ecosystem.

Conflicts over the depleting resources are not confined by administrative boundaries. Solutions to the issues must therefore be reached through consensus-building and a collective effort from all stakeholders. In recent years, only localized management initiatives have flourished, including the establishment of small marine protected areas (MPAs) and coastal law enforcement. None of the past or current major national coastal resource management (CRM) initiatives have included the Visayan Sea, and until recently no integrated effort has been made to address its problems.

Project Concept and Its Early Development

The project concept for an integrated Visayan Sea Coastal and Fisheries Resources Management Project (VisSea) was developed in late 1998. It envisaged the 22 LGUs surrounding the Visayan Sea as key implementers with technical support from BFAR and the University of the Philippines in the Visayas (UPV). The initial design was based on a community-based CRM approach, where collective efforts of the stakeholders result in sustainable resource management and utilization and, ultimately, in improved socioeconomic conditions for the participating coastal communities.

The project framework evolved through four provincial consultation workshops held with key stakeholders ranging from fisherfolk representatives to mayors and provincial governors. A covenant, indicating their interest and readiness to cooperate towards solving the resource use constraints, was signed during the fifth workshop. It became clear that the costs of a sustained effort of this scale, with a high demand for capacity-building and institutional strengthening, would go beyond the regular budgets of the envisaged cooperators. PCAMRD through the National Economic and Development Authority (NEDA) thus endorsed the draft VisSea Project for foreign funding support. In December 1999, the Government of Germany expressed willingness to support its implementation, pending the positive results of an in-depth project appraisal. The Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) was tasked to carry out the appraisal.

VisSea Appraisal Process

GTZ chose a participatory approach, instead of a conventional project appraisal mission. Three workshops between May and December 2000 were held in three provincial cities where the stakeholders identified issues and constraints to better coastal management. This resulted in a project design that integrated the local needs as well as the comments of the appraisal team. Further inputs for the workshops and project design came from the original proposal, a desk study on the Visayan Sea and CRM in the Philippines, commissioned by GTZ and carried out by the International Center for Living Aquatic Resources Management (Viswanathan *et al.* 1999), and two socioeconomic studies of the project area commissioned by PCAMRD.

The first "visioning" workshop brought together more than 60 participants (from fishers' and nongovernment organizations, LGUs, the academe and national government agencies) and determined entry points for the proposed project. Aspirations towards a common vision encompassed ecology and conservation, resource utilization, socioeconomics, and cultural, institutional and governance concerns. This participatory analysis yielded a wealth of information on possible collaborators, areas of concern and measures to address current issues (Zaragoza *et al.* 2001).

Provincial focal persons identified at the conclusion of the workshop served as links and information channels between the appraisal team and national counterparts and local stakeholders. They coordinated the gathering of additional background material and disseminated information on the status of project preparation.

The vision which had emerged from the first workshop was validated at the start of the second workshop in August 2000: "the Visayan Sea as one of the richest, sustainable, bio-diverse and well managed coastal and marine resources of the country, is significantly contributing to the improvement of the socio-economic situation of the coastal population." This vision was adopted as the future development goal of the project. The project purpose, which will address the needed change triggered by the project's expected impact on present conditions, was defined as follows: "important stakeholders of the provinces embracing the Visayan Sea jointly manage the marine resources to increase its productivity".

Groups discussed the key concerns of legislation and policy, information and research, and resource use. Various issues and gaps were identified, from which five major results or outputs were proposed:

1. a plan for managing the resources of the Visayan Sea jointly formulated and implemented;
2. improved CRM practices implemented by LGUs and local communities;
3. an information base for resource management and monitoring is established and utilized;
4. networking among different stakeholders; and
5. alternative income-generating opportunities for coastal communities are tested and supported.

Important discussions focused on the possible design of the project organization structure, including a steering committee as the policymaking body, a general assembly representing more diverse groups of stakeholders, and a project management office which would manage the ground implementation and coordination of activities. Implementation at LGU and community levels will largely be done through existing structures.

In a final workshop, the design of the organizational structure was finalized and an agreement was reached on the proposed national executing agency, BFAR. Since final approval and acceptance by the two governments would still take some time, a plan of operations for a pre-implementation phase (2001 and early 2002) was drawn up to ensure a smooth startup. Activities for this phase included further information gathering and improvements of the initial database for monitoring purposes, formation of the interim steering committee and preparation of budget allocations.

Initial Steps of Project Implementation

A project with this degree of complexity requires formal structures to facilitate implementation. The signing of the Memorandum of Agreement among the participants was held in September 2001 in Iloilo, and the start of the German government contribution to the project was launched in May 2002 after the constitution of the Project Steering Committee (PSC). Project duration of up to eight years is envisaged, consisting of two implementation phases of three years each, and two years for any further assistance. As an advisory group to both PSC and project implementers, a Technical Working Group was constituted.

The need to enhance the capacity of LGUs and other collaborators in the implementation of better CRM practices was recognized by the PSC. Thus, a Graduate Scholarship Program was initiated in June 2002. Five scholarships in Master of Marine Affairs at UPV were awarded to LGU personnel from Iloilo and Negros Occidental as well as BFAR staff.

To realize the five major project results, the stakeholders identified key activities through a series

R. Hermes

On-board seminar during the Visayan Sea cruise discussing the "mind map" of management issues.

of provincial priority-setting workshops between November 2002 and February 2003. Based on the workshop results, and after including further activities for integration of approaches and improved fisheries management, a plan of operation was formulated in April 2003.

Information Base for Resource Management and Monitoring

During 2002, PCAMRD through UPV undertook a survey of existing information on Visayan Sea. The reference collection resulting from this activity provides input and guidance for project implementation. However, updated information is still needed on the status of fish stocks and habitats and municipal coastal profiles, including registry of fishers, gears and boats.

In May 2003, the project sponsored a workshop on the integration of data collected by the BFAR National Stock Assessment Project (NSAP) in Regions 6 and 7, both of which were collecting data in their respective jurisdiction in the Visayan Sea. The workshop stressed the need for uniformity in methods used for data collection, processing and integration. Expected results will include information on maximum sustainable yield, exploitation rates and yields of certain species, as well as an inventory of fishing gears used for the major part of Visayan Sea.

A research cruise in July 2003 was combined with an integrated coastal management (ICM) training to generate information on hydrobiological parameters and the state of demersal fish stocks. A trawl survey was conducted that used the data collected in 1976–1977 (Aprieto 1978) as a benchmark for comparison, alongside oceanography and plankton research. Processing and analysis of samples and data, which will include fisheries information, such as species composition, biomass / density, length frequency and sexual maturity, were started. These data, as well as the integrated data of NSAP, will be used to pursue the ecosystem-based approach to management.

Preliminary information indicates a moderate demersal standing stock of around 2 t / km^2, composed mainly of low-value fish species, and the almost complete absence of higher-value fish such as groupers, snappers and threadfin bream. Relatively high catches of squids must be considered further indications of ecosystem overfishing.

These data will lay the base of the Visayan Sea joint management plan alongside the inputs of various stakeholders and participatory planning workshops conducted in previous years.

Implementation of Improved CRM Practices

The LGUs identified MPAs, mangrove rehabilitation, fishing gear regulation and fisheries law enforcement, and strengthening of Fisheries and Aquatic Resource Management Councils as their priority areas. The project has so far co-sponsored a workshop on the unification of municipal fisheries ordinances in Iloilo and initiated the training needs assessment for MPA establishment in Masbate. Proposals for further activities are being evaluated.

R. Hermes

Setting the research trawl for demersal fish stock assessment during the Visayan Sea cruise.

Networking

The need for networking as a requisite for joint management is stressed in all workshops, trainings and similar activities conducted by the project. A series of orientations has been held with LGUs, nongovernment organizations and people's organizations to create awareness regarding the project's thrust and progress and to solicit insights among participants. As part of the information, education and communication campaign, brochures and newsletters are published for distribution to stakeholders, local media and other interested parties.

Access to alternative income

In 2002, implementation of pilot livelihood projects was started with financial support from PCAMRD: tilapia hatchery and nursery in Balasan, Iloilo; seaweed culture in Cadiz City, Negros Occidental; grouper cage culture in Balud, Masbate; and crab net fishery in Bantayan, Cebu. Both crab net fishery and tilapia hatchery are operational and produce income, while the full implementation of grouper culture has been delayed and the seaweed farming venture is still recovering from a disease, leading to slow growth and necessitating early harvest. A proposal for training needs assessment and capacity-building in fish processing technology and other post-harvest aspects is under evaluation.

Conclusion

The crosscutting goals of food security and poverty alleviation provide the mandate for all efforts aimed at sustainable management of the coastal resources and fish stocks of the Visayan Sea. Given the complex nature of resource use issues and connectivity of ecosystem processes across existing political and administrative boundaries, this can only be achieved through a combination of local interventions within the framework of integrated resources management jointly formulated and implemented by all concerned stakeholders.

References

Aprieto, V.L. 1978. Trawl fishing investigations on traditional and non-traditional fishing grounds in the Philippines: Hydrobiological studies of the Visayan Sea demersal fisheries. Institute of Fisheries Development and Research, College of Fisheries, University of the Philippines. 52 p. and annexes. (Unpublished).

Armada, N.B. 1999. Preliminary evaluation of possible effect of El Niño on the small pelagic species in the Visayan Sea, p. 44-54. *In* H.R. Rabanal (ed.) Impacts of El Niño on Philippine fisheries. PCAMRD Book Ser. 27/1999. Laguna, Philippines.

BFAR (Bureau of Fisheries and Aquatic Resources). 2000. Philippine fisheries profile 1999. BFAR, Quezon City, Philippines. 52 p.

Viswanathan, K., B. Katon and L. Garces. 1999. Integrated Visayan Sea coastal resources and fisheries management program (VisSea). Desk review for the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). International Center for Living Aquatic Resources Management, Penang, Malaysia. 40 p. (Unpublished).

Zaragoza, E.C., R. Hermes, N.B. Armada and U. Lohmeyer. 2001. Participatory project design process for coastal resources management of the Visayan Sea, Central Philippines. Proceedings of the 12th Biennial Coastal Zone Conference, 15-19 July 2001, Ohio, USA.

Danao Bay Community-based Coastal Resource Management Project: From Top Down to Bottom Up[1]

WILLIAM R. ADAN
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Philippines

Introduction

Danao Bay is located on the northeastern shore of Mindanao in the province of Misamis Occidental. The bay is generally shallow but is composed of highly productive mangroves, mudflats, coral reefs and seagrass beds. It has an area of about 2,000 ha bordering the municipalities of Baliangao and Plaridel (Figure 1).

Anecdotal records and historical testimonies claim that Danao Bay used to be very rich in coastal and fishery resources. In fact, the name of the municipality of Baliangao is accordingly derived from the Cebuano term *balay sa langaw* meaning house of flies. This referred to the swarms of flies always present in the area feeding on fish that could not be consumed and so decomposed along the town's shoreline.

Up until the 1950s, fish were still abundant in the bay and lush mangroves covered 300 ha. In the 1960s, however, things began to change. People from Bohol came to Baliangao to extract *tungog* from the bark of the *malatangal, Ceriops tagal*, which is used for coconut wine *(tuba)* as well as to make commercial charcoal, decimating the majority of mangrove trees. Today there remain only 20 ha of original (primary) mangrove stand, and this is only due to a private claimant who stood firm in protecting it. About the same time, dynamite fishing became rampant damaging the fragile coral reefs that fringed the bay. Thereafter everything changed in Danao Bay: fish became scarce, sea cucumbers and even sea urchins and different species of seashells became smaller and less abundant. This impacted on the 600 fishing households which were solely dependent on fishing for their source of income (Heinen and Frazer 2001).

Pipuli Foundation

Arriving in Danao Bay in 1991, the Pipuli Foundation saw the strong link between the livelihood of the local people and the state of the bay. Soon it realized that there was an urgent need to protect the resources of the bay from further degradation and destruction. Contacts were made with local leaders and with the assistance of the parish priest and some lay leaders of Baliangao, Pipuli convinced the municipal mayor to establish a marine sanctuary in the area. On 31 July 1991, the local government of Baliangao passed a resolution establishing a 150-ha marine sanctuary, known as Misom Sea Sanctuary (Figure 1).

The establishment of the Misom Sea Sanctuary generated massive opposition and, at times, violent resistance from "displaced" fishers. They said they were suddenly deprived of their traditional fishing ground. A compromise was finally reached to reduce the area to 74 ha. The four workers of Pipuli, with a few local coastal resource management (CRM) converts, took it upon themselves to put the sanctuary in place and manage it. Guarding the sanctuary proved to be the most difficult problem faced by the foundation. Day and night, trespassers from within and outside the bay kept coming and fishing right inside the fenced restricted area, threatening the guards.

---

[1] This paper can be cited as follows: ADAN, W.R. 2004. Danao Bay Community-based Coastal Resource Management Project: From top down to bottom up, p. 318-321. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

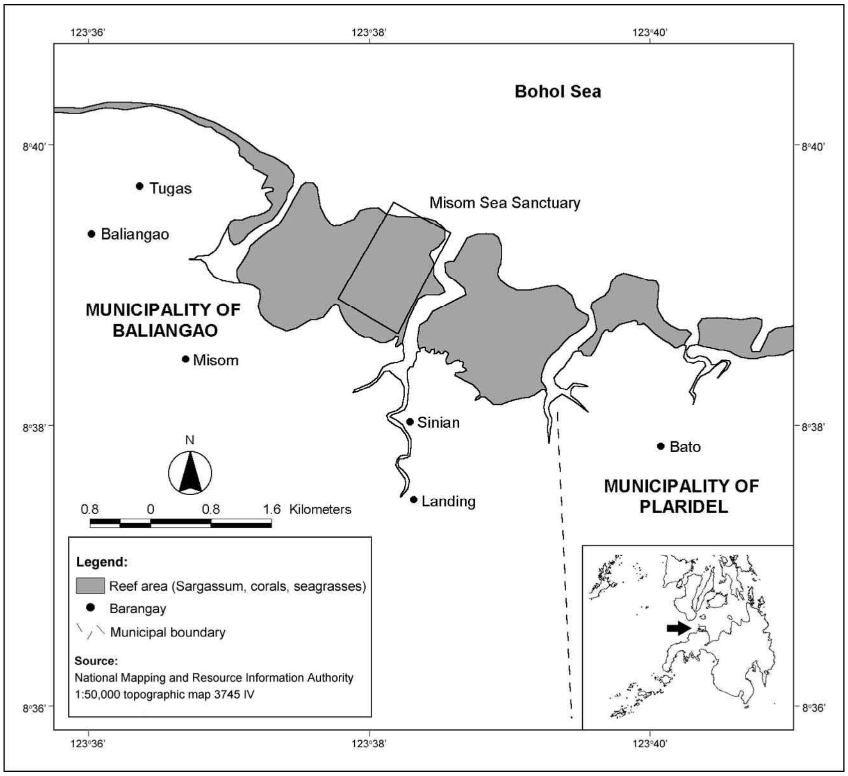


Figure 1. Location map of Danao Bay in Misamis Occidental showing location of Misom Sea Sanctuary.

Baliangao Wetland Park

Meanwhile, blast, fine mesh fishing and fish poisoning continued within the bay. While the sanctuary was in relative safety, it dawned on the Pipuli staff that the whole situation was problematic. The unilateral and authoritarian creation of the sanctuary, in fact, gave the illegal and destructive fishers more reason to continue their activities. Pipuli tried to correct its steps and pushed for the creation of a management board for a more participatory management of the sanctuary.

The board was created in March 1994, chaired by the municipal mayor. The members included representatives from the Department of Environment and Natural Resources, parish church and local fishery school, the community at large, four barangay captains, four guards and one Pipuli staff. The foundation hoped that with the mayor and the barangay captains in the municipality at the helm of management, resistance from the people would dwindle and order would prevail in the bay.

Looking forward to its eventual disengagement from the Misom Sea Sanctuary Project, and thinking that the project would gain further protection and generate funding support from the government, during the mid-1990s, Pipuli applied for the recognition of the project as an integrated protected area system (IPAS) under the National Integrated Protected Area System Act of 1992. The DENR facilitated the request and suggested a mangrove-line river close to the sanctuary as part of IPAS. Henceforth, the Misom Sea Sanctuary became known as the Baliangao Wetland Park pending approval of IPAS application. Then some five years later, on 22 November 2002, Pres. Joseph Estrada issued a Presidential Proclamation declaring and renaming the park as Baliangao Protected Landscape and Seascape (BPLS), which has a mangrove and sea area of 294,998 ha.

Danao Bay Community-based CRM Project

The workers of Pipuli recognized that the top-down approach it had adopted in organizing the conservation and rehabilitation project in the bay just did not work. They realized that simply policing the confines of the sanctuary by hired men or volunteers was not enough and was definitely unsustainable. It was perceived that unless all the coastal communities would be involved in the management of the bay, nothing much could be done to change its present state. The Misom Sanctuary would remain in constant threat from concerned fishers if conservation and management efforts were focused mainly on the sanctuary and not on the people using it.

Pipuli re-conceptualized its approach and embarked in a baywide community organizing approach. It trained community organizers to engage the coastal folk in a running dialogue and analysis of ecological and sustainability issues on resources. The education and conscientization effort eventually paid off. A good number of fishers began to recognize the collective need and responsibility to protect the resources for their sustainable use. After all, they realized that they and their families were the main beneficiaries of these activities. The positive results of the resource assessment of the sanctuary by Silliman University in 1993, 1994 and 1995 provided hard evidence supporting the campaign for resource conservation.

Eight fishers' associations from eight coastal barangays of the bay sprang to life and began protecting their coastal waters through organized volunteers. Many illegal fishers who used to poach in the sanctuary became converts to the cause of CBCRM and ardent protectors of the bay. By 1998 after about three years of intense community organizing work, incidents of illegal fishing in the bay had been drastically reduced.

Danao Bay Resource and Environment Management Organization

Before its formal disengagement from the area in October 2002, Pipuli labored to secure the gains it made in its CBCRM Project by federating the eight fisherfolk associations under an umbrella organization known as the Danao Bay Resource and Environment Management Organization (DBREMO). Since 2000, DBREMO became the *de facto* manager of the entire Danao Bay that includes the Baliangao Protected Landscape and Seascape.

The paradigm shift from top-down to bottom-up approach in the management of the bay gave more emphasis on people's participation with less and less involvement of the local government units (LGUs) and other stakeholders. This imbalance has distanced the organization from LGUs that, under the Local Government Code of 1991, are mandated to provide leadership in the management of resources in their municipal waters. This development resulted in a growing unconcern and lack of support and cooperation from LGUs in DBREMO's management activities in the bay.

Recognizing this, DBREMO started repairing bridges and renewed networking and advocacy work with LGUs. The current crop of government officials in the municipalities of Plaridel and Baliangao, and the province of Misamis Occidental are oriented on CRM activities in Danao Bay – the gains, problems and need for sustainability. Immediately, the two LGUs responded by each assigning a composite team of the Philippine National Police and *Bantay Dagat*, complete with patrol boats and surveillance paraphernalia.

Danao Bay Declaration as a Special Demarcated Use Area

DBREMO vigorously worked for a comprehensive baywide ordinance for Danao Bay to gain legal basis for its activities and for managing the bay. Finally in two separate ordinances from Baliangao and Plaridel, DBREMO was recognized and tasked with developing and implementing a resource management program for Danao Bay. The ordinance also adopted a color-coding system for the bay to monitor and limit the entry of fishing boats and the imposition of heavier penalties on violations committed within the territorial jurisdiction of Plaridel.

The common municipal ordinance (MO), which is MO No. 1, Series 2002 for Baliangao, and MO 5, Series 2002 for Plaridel, is entitled "Declaring Danao Bay as a Special Demarcated Fisheries Area and Granting an Authority to Danao Bay Resource and Environment Management Organization (DBREMO) to be Partner of the Local Government Units (LGUs) of the Municipalities of Baliangao and Plaridel, Province of Misamis Occidental to Implement the Resource Management Program of said Bay, and for Other Purposes in which the Control and Supervision is under LGUs." The ordinance gives preferential fishing right to registered fishers for resource use and rehabilitation and conservation, and other related concerns in the bay. The event has institutionalized the partnership of a cohesive people's organization (DBREMO) and the local government authorities, a crucial development in securing and sustaining initiatives and gains in CRM.

Lessons Learned

"The bay was almost totally barren in 1991 before the Pipuli Foundation came. The establishment of the sanctuary, education and mobilization of the people along CRM are now bearing fruits. The fish, the sea cucumbers and the shells are here again. The challenge now is before us, how to protect and sustain the gains brought about by Pipuli now that it has disengaged from the area," said Celso Balabad, a fisher from Barangay Tinago, and a member of DBREMO.

In less than a decade, about 100 ha of mangrove area were successfully reforested and another 100 ha of second growth mangrove trees were restored to their natural state by community effort. The establishment of a marine sanctuary and the people-imposed regulations in the exploitation of resources have gradually brought back the richness of the bay. Corals have regenerated.[2] Fish species diversity, particularly in the protected area, has increased from 48 (1993), 75 (1994), 85 (1995) to 93 species belonging to 25 families in 1997.

The Future

At present, an effort in setting up a supra-management body known as the Danao Bay CRM Council (DBCRMC) is ongoing. This development has created mixed feelings among DBREMO staff and members. They are happy that what they worked for is being realized but are also anxious on the eventual impact of DBCRMC on the existence and survival of DBREMO.

This feeling of anxiety is not without basis. Conceived as a blessing, the development of BPLS became a thorn of DBREMO. The Protected Area Management Board (PAMB) began to impose its territoriality in the area in the management of BPLS. Some irritants surfaced in the relationship between DBREMO and PAMB, although later PAMB recognized the existing priority management right of DBREMO over the bay. No funding support has resulted from the IPAS declaration. Instead, DBREMO has to share with the government 50% of the income it earns from entrance fees of visitors to the sanctuary.

The eventual creation and operation of DBCRMC caused apprehension among DBREMO staff as similar conflicts might arise. This apprehension may, however, be unfounded. First, the municipalities of Baliangao and Plaridel recognize DBREMO as their partner in the implementation of their CRM program in the bay as provided for in the two common LGU ordinances. Second, in the proposed composition of the new council, not only the chair of DBREMO will sit in the council, but also the organization will occupy a key position as secretariat. As such, it will be in a vantage position to influence the agenda and policy direction of the council.

It seems that some of the key ingredients for a sustainable management mechanism for Danao Bay are coming closer to reality.

Bibliography

Adan, W.R. 2001. Institutionalization of alliances in Region IX and formulation of manual of operations. Project Terminal Report. Philippines-Canada Local Government Support Program, Region IX, Dipolog City, Philippines.

Garucho, R.D. 1997. Coastal resource management and local governance: A status report on local government support program interventions. Paper presented during the Regional Workshop on Integrated Management of the Coastal Zone, 26-27 June 1997, Makati City, Philippines.

Heinen, A. and J. Fraser 2001. Power politics of rational resource management: Fish corrals versus trammel nets in Danao Bay. Tambuli 7:30-34.

[2] The Danao Bay reef was selected as the third best managed reef in the Philippines for the International Year of the Reef in 1997. The CBCRM Project of Danao Bay was also among the top four model development projects on environment and natural resources in the Philippines in the search conducted in 1997 by the Integrated Environmental Management for Sustainable Development.

Panguil Bay: Change over Time in Fisheries[1]

MARCELINO I. TUMANDA, JR.
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Philippines

Introduction

The primary goal of fish stock assessment is to provide benchmark information on the current status of the fish stock, compare this with the current level of exploitation and find the exploitation level that would give the maximum yield from the fishery while ensuring that the stock remains intact (Sparre 1987). This information gives appropriate authorities in charge of fisheries management, local government units (LGU) and the Bureau of Fisheries and Aquatic Resources (BFAR) a specific idea of what the state of stocks is vis-à-vis fisheries management interventions in place while giving some ideas on the level of effort optimal for the resource in question.

This case study gives an interesting overview of Panguil Bay prior to fisheries management interventions of the Fisheries Sector Program (FSP) and its state after the program had ended. It indicates that despite the many years of fisheries management interventions in Panguil Bay, this program did not achieve the desired goals of optimal use of the bay's resources and improvement in fishers' income.

Resource and Ecological Assessment

Towards the end of 1990, Mindanao State University (MSU)-Naawan was tasked by FSP of BFAR (funded by the Asian Development Bank and the Japanese Bank for International Cooperation) to conduct a resource and ecological assessment (REA) of Panguil Bay. The key objective of this assessment was to generate baseline information upon which a coastal resource management (CRM) plan and fisheries interventions appropriate to the area could be developed. Five years later (1995-1996), a post-REA was conducted following a similar format to document changes since the beginning of the interventions.

The site

Panguil Bay in northwestern Mindanao is shared by the provinces of Lanao del Norte and Misamis Occidental (Region 10) and Zamboanga del Sur (Region 9) (Figure 1). Its narrowest width is about 1.7 km between Silanga, Tangub City and Tubod, Lanao del Norte, while its widest breadth at the bay's mouth is about 11.5 km (MSU 1996). Its irregular coastline measures about 112 km, while the distance between the innermost reaches in Lintugop, Aurora, Zamboanga del Sur, to its mouth at Iligan Bay is about 41 km. The bottom topography is irregular with average and greatest depths measuring about 15.4 m and 55.0 m, respectively. There are 29 major and 46 minor river tributaries that transport freshwater, nutrients and sediments into the bay (Figure 1).

Fish stock assessment

The fisheries resources of Panguil Bay are a major source of livelihood for sustenance fishers in the area. Approximately 36,000 families from the three provinces reside along the bay (NSO 1994) of which at least 10% depend directly on it for their livelihood. In 1991, some species of the bay were already in an advanced state of being overfished particularly crustaceans where fishing mortality (F) was, for some species, already between 55% and 79% of the total mortalities (Z) (Acuña *et al.* 1992).

Some 120 species of finfish belonging to 65 families were identified from landed catches in 1995-1996, which was fewer than the 145 species reported in 1991 (Table 1). The most abundantly caught species were the gray mullet (*Mugil cephalus*), anchovy (*Stolephorus commersonii*) and oil sardine (*Sardinella longiceps*), with

[1] This paper can be cited as follows: TUMANDA, M.I., JR. 2004. Panguil Bay: Change over time in fisheries, p. 322-326. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

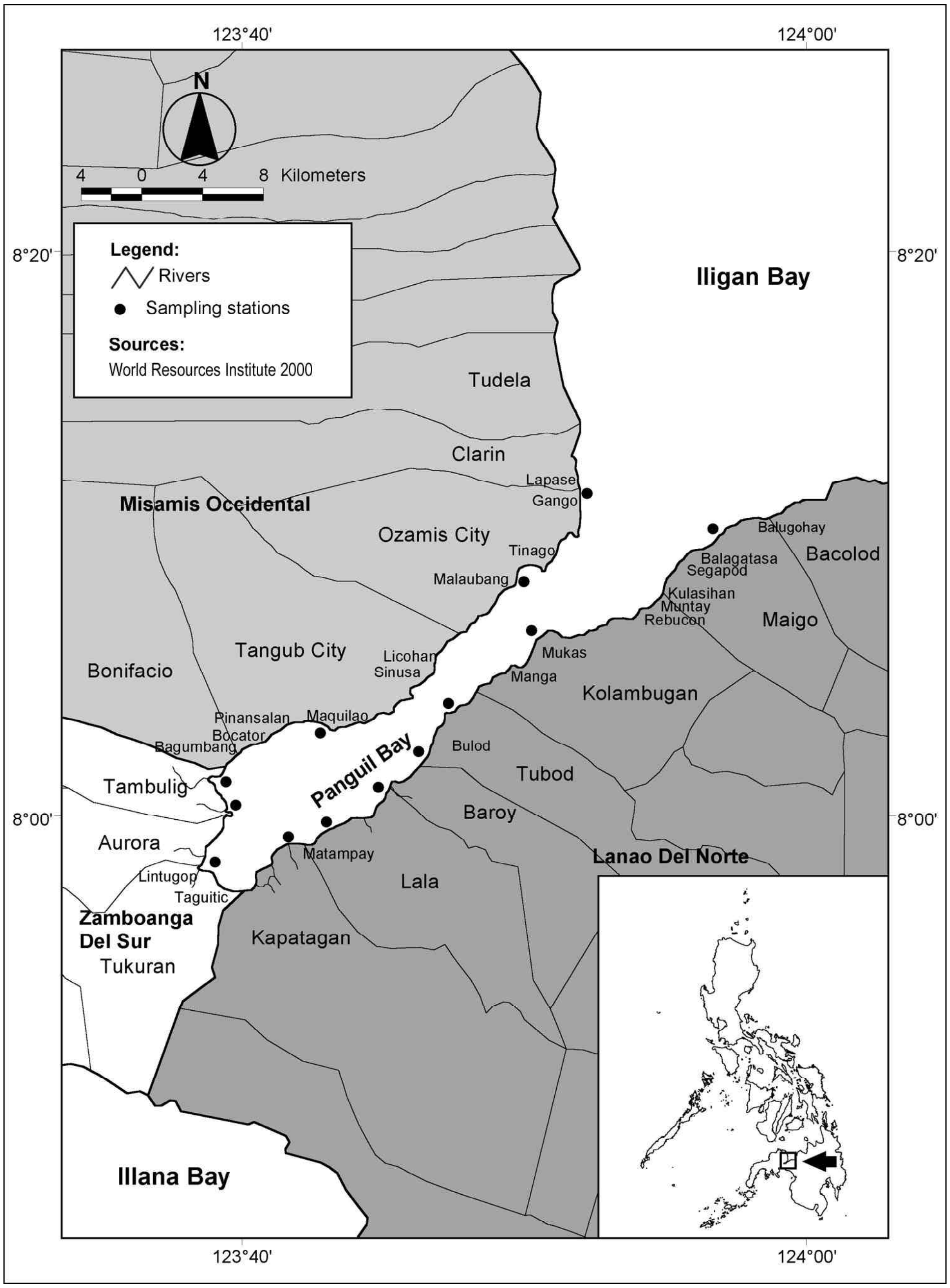


Figure 1. Panguil Bay and the location of monitoring stations (•) used during the 1991 and 1995-1996 fish stock assessments.

Table 1. Profile of landed catches in Panguil Bay in 1991 and 1995-1996.

Group	Total No. of Species		Total Landed Catch (t)	
	1991	1995-1996	1991	1995-1996
Finfish	145	120	177.8	763.8
Crustaceans	12	12	391.6	88.2
Total	157	132	569.4	852.0

an aggregate catch of 34.8 t, representing 27.7% of the total recorded catch from 13 stations.

More than 20 different kinds of fishing gear were operating in the bay in 1995-1996 while only 17 were noted in 1991. The number of fishing gear in the bay doubled from 3,208 units in 1991 to 6,494 units in 1995-1996 therefore explaining the huge increase in landed finfish catch in the latter period. By 1995-1996, there had been an observed proliferation of giant filter nets *(sanggab)* (Figure 2)in certain parts of the bay, but most operators declined to declare their actual catches, thus the recorded catches were an underestimate of the total production of the bay.

Socioeconomics

The average gross income of fishers in Panguil Bay in 1991 was estimated at P93 per day or roughly P2,160 per month (based on 23 days per month work). This was much lower than the poverty threshold level of P126 per day as estimated by the National Economic and Development Authority (NEDA) in 1991 (Adan *et al.* 1992). The average net income of fishers during the 1995-1996 NEDA survey was P123 per day or P3,690 per month. Despite an increase, these values were still below the poverty level index at that time of P6,000 per month and barely equivalent to the 1991 income of P2,160 per month after inflation (MSU 1996).

Crustacean resources

The species composition, total recorded catches and percentage change in crustacean catch monitored in 1991 and 1995-1996 are presented in Table 2. The largest volume of crustacean catch usually came from the inner portion of the bay. There was a reduction of about 77% in total crustacean catch in 1995-1996 compared to 1991. Among the different gears, the bottom-set gillnet had the highest catch per unit effort (CPUE) (3.52 kg day^{-1}), followed by crab pot (2.24 kg day^{-1}) and fish corral (1.95 kg day^{-1}). The average CPUE of 0.87 kg day^{-1} for all the gear was lower than that in 1991 (1.02 kg day^{-1}), suggesting that the crustacean fishery in Panguil Bay had declined considerably for reasons not yet understood.

Coastal Resource Management Interventions

Since 1991, many CRM interventions had been implemented in the bay which can be classified into four broad categories: (1) enhancement and rehabilitation, (2) community organizing and information dissemination, (3) credit assistance and (4) coastal law enforcement.

Enhancement and rehabilitation projects included mangrove reforestation and deployment of artificial reefs. About 539 ha of mangrove areas were reforested in Panguil Bay through the Department of Environment and Natural Resources' Coastal Environment Project, costing about P4.4 million. This involved about 172 family and 10 community contractors. Survival rates of planted mangrove seedlings were 45-95% (MSU 1996). A total of 132 artificial reef modules were deployed by local residents with assistance of LGUs all near the mouth of the bay only. The artificial reefs were not well-monitored so it is still unclear whether they

Table 2. Species composition, total catch and percent change of major crustaceans in Panguil Bay during the 1991 and 1995-1996 surveys.

Species	Local Name	Total Recorded Catch (t) 1991	1995-1996	Change (+/-)	% Change
Shrimp					
Metapenaeus ensis	*bagalan*	106.38	32.84	-73.54	-69.13
Metapenaeus sp.	*sudsuron*	-	13.44	-	
Penaeus merguiensis	*lunhan*	45.65	10.50	-32.15	-77.00
P. monodon	*sugpo/pansat*	-	4.73	-	
P. indicus	*putian/lunhan*	15.52	-	-	
Other shrimps		45.89	21.50	-24.39	-53.15
Total		213.44	64.01	-149.43	
Average % reduction					-66.43
Crabs					
Scylla spp.	*alimango*	125.08	11.69	-113.39	-90.65
Portunus pelagicus	*lambay*	50.26	11.79	-38.47	-76.54
Other crabs		2.83	0.66	-2.17	-76.68
Total		178.17	24.14	-154.03	
Average % decline					-81.29
Grand total		391.61	88.15		

Figure 2. Stationary fine-mesh liftnets in Panguil Bay.

assisted rehabilitation or merely functioned as fish aggregation devices, further depleting the local fish stock.

Community organizing activities were carried out by two nongovernment organizations (NGOs) contracted by FSP beginning in 1990. A total of 72 fishers' cooperatives were organized covering almost all the coastal barangays of the three provinces bordering the bay. The objective was to enable these organizations to assist with coastal resource protection and rehabilitation. However, the cooperatives were only active while the NGOs were present. Upon the termination of the NGO contracts, many of the activities also slowed down or totally ended.

Credit assistance was provided by various credit institutions. Unfortunately, these assistance programs failed in most cases, primarily because of nonpayment of loans by creditors.

Various municipal and city ordinances have been passed by LGUs to curb illegal fishing and protect the environment. Fisheries administrative orders, executive orders, resolutions and other applicable national laws on fisheries management have not been enforced in Panguil Bay. Despite the existence of these laws and enforcement efforts by authorities concerned, illegal fishing practices have persisted, primarily caused by poor community organization, poverty and absence of strong political will from both local government and community.

Conclusion and Management Implications

The information generated by the 1991 REA and the 1995-1996 post-REA of Panguil Bay has indicated a large increase in finfish catch. The reasons for this include a probable underreporting of catch in 1991 and increasing effort in 1995, in spite of increasing overexploitation of finfish. There has been a significant decline in crustacean catch compared to 1991 data. The clandestine deployment of certain illegal gear (i.e., filter nets and trawl fishing), which were earlier banned either by local ordinances or resolutions by the Panguil Bay Development Council (PBDC) and the proliferation of traditional ones (i.e., fish corrals and encircling gill nets) have contributed to this decline.

There is loss of finfish diversity in the bay. The hydrobiology and ecology study of Panguil Bay conducted by Sanguila *et al.* (1984) reported 201 species of finfishes. The assessment made in the 1991 REA indicated only 145 species, or a reduction of 56 species. The 1995-1996 post-REA survey listed only 121 species of finfishes or a loss in finfish diversity of about 40% from the 1984 records.

The decline in crustaceans can also possibly be attributed to the continued use of highly efficient gear, such as fish corrals (using very fine mesh nets) and *sanggab*, which can filter even tiny larvae of the species. The *sanggab* is known to damage the overall fisheries of the bay. The diminishing population of crabs is also attributed to the harvest of juvenile crabs (*Scylla* spp.) for rearing and fattening projects that were mostly done outside the Panguil Bay area. Most of the shrimp and crabs in the samples were either of small size or juveniles, which further indicates that the fishery shifted to exploitation of young populations. The removal of immature crustaceans has contributed to decline of spawning populations, a condition known as recruitment overfishing.

Analyses of exploitation levels and yield predictions using the Thompson and Bell model (Gayanilo *et al.* 1994) indicate that increasing current levels of fishing effort to expand the fisheries is not sustainable. Fish biomass has already been reduced below optimum levels. Management options should include regulation of the amount of daily catch and total closure of certain areas, and closure of other areas at specific times of the year to allow recovery. These steps need to be supported by public education and other forms of advocacy.

The management of fishery resources of Panguil Bay requires an integrated multisectoral approach coupled with a strong and dynamic political structure and organization that can implement the bay fisheries management plan. Towards this end, PBDC, which is composed of provincial and municipal officials around the bay, must be strengthened and revitalized to carry out its fisheries action plan, involving the participation of coastal communities.

The state of the bay shows that despite the presence of a large, well-funded project that supported fishers' organizations and initiated many coastal management practices, there is a long way to go to improve fisheries management. Evidence suggests that many of the fish resources were already overexploited in 1991 (Acuña *et al.* 1992). This calls for a stronger policy environment, and that five years for project implementation is not long enough.

Since FSP was initiated in 1991, the number of fishing gears in the bay has more than doubled. This shows that the open access nature of the fisheries has only become worse. Reducing fishing effort within the bay is essential to improve the status of fisheries resources. Habitat protection and closed areas are essential to rehabilitate the bay.

References

Acuña, R.E., A.E. Openiano and A. B. Apongan. 1992. Resource and ecological assessment of Panguil Bay: Finfish resources. Terminal Report, Vol. III. 58 p. Mindanao State University, Misamis Oriental, Philippines.

Adan, E.Y., F.M. Valdez, M.Y. Salarda and W.R. Adan. 1992. Resource and ecological assessment of Panguil Bay: Demographic and economic pressures in Panguil Bay. Terminal Report, Vol. I. 75 p. Mindanao State University, Misamis Oriental, Philippines.

Gayanilo, F.C., P. Sparre and D. Pauly. 1994. The FAO-ICLARM stock assessment tools (FiSAT) user's guide. FAO Comput. Inf. Ser. (Fish.) No. 6, 186 p. FAO, Rome, Italy.

MSU (Mindanao State University). 1996. Post-resource and ecological assessment monitoring and training project in Panguil Bay. Terminal Report. 343 p. Mindanao State University at Naawan, Misamis Oriental, Philippines.

NSO (National Statistics Office). 1994. Family income and expenditure survey. Integrated survey of households. Bull. Ser. 80. Final Report, Vol. II. 378 p.

Sanguila, W.M., H.J. Vicente, N.C. Mendoza, R.E. Acuña, M.I. Tumanda, Jr. and M.T. Daitia. 1984. Hydrobiology and ecology of Panguil Bay – II. Fisheries resources CPUE. MSU-IFRD Res. Tech. Rep.: 28-104.

Sparre, P. 1987. Computer programs for fish stock assessment for Apple II computers. FAO Fish. Tech. Pap. (101) Suppl. 2: 218 p.

A Local Government Alliance Approach to Integrated Coastal Zone Management: The Gingoog Bay Development Council Experience[1]

WILLIAM R. ADAN
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Philippines

Introduction

The passage of the Local Government Code (LGC) of 1991 (Republic Act 7160) allows local government units (LGUs) to group themselves and to consolidate and coordinate their efforts, services and resources for purposes commonly beneficial to them (Section 33). Moreover, to promote democratic participation in governance, the law provides that LGUs may enter into joint ventures or cooperative agreements with people's organizations (POs) and nongovernment organizations (NGOs) to engage in the delivery of basic services that would increase productivity and income, promote ecological balance and improve the general well-being of the people (Section 35).

In response to this new mode of governance, LGU alliances have begun to sprout in areas usually with common resources and ecosystems, such as watersheds, rivers, bays and gulfs (Adan 2001). This ecosystem approach in the formation of alliances addresses problems in a more holistic manner which is badly needed for resources that are very mobile, such as pelagic fishes.

Of the eight Local Government Support Program (LGSP)-assisted LGU alliances in Mindanao (Garucho 1997), only the alliance in Gingoog Bay was formally established by the national government.[2] The rest have remained in their original state with legal basis in the memorandum of agreement they have entered into by and among themselves as approved by their respective municipal / city council (*Sangguniang Bayan/ Panlungsod*). This case study looks at the evolution of one such alliance.

Gingoog Bay Development Council

The Gingoog Bay Development Council (GBDC) evolved from various consultations held by LGU leaders and concerned citizens in the area on the worsening condition of the fishery resources of the bay and from lobbies on the need to alleviate the socioeconomic condition of the coastal folk. Various forms of illegal fishing operations brought havoc to fishery resources of the bay, causing continuing decline in fish catch of municipal fishers. Moreover, key habitats of the ecosystem - coral reefs, seagrass beds and mangroves - have been gradually and insidiously damaged by unregulated exploitation, siltation and pollution emanating from land-based human activities.

Recognizing the need to address the problem holistically through participatory and collaborative efforts, LGUs along Gingoog Bay formed an alliance with assistance from the Philippines-Canada LGSP of Region X, Northern Mindanao. The alliance sought legal recognition from the Philippine President to institutionalize funding support. The efforts paid off when the Office of the President (OP) created GBDC under Executive Order (EO) No. 234, as amended by EO No. 300, in April 1995. The creation of GBDC is in line with the current thrust of national government,

---

[1] This paper can be cited as follows: ADAN, W.R. 2004. A local government alliance approach to integrated coastal zone management: The Gingoog Bay Development Council experience, p. 327-331. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

[2] The other seven LGSP-assisted alliances in various regions are: Illana Bay Regional Alliance (Autonomous Region in Muslim Mindanao), Illana Bay Regional Alliance (Region IX), Panguil Bay Development Council, Salug Valley Development Council, Dumanugillas-Maligay Bay Development Council, Murciellagos Bay Management Council and Dapitan-Dipolog-Katipunan-Roxas-Manukan Development Council.

that is, "preserving the country's marine and coastal resources through community-based efforts consistent with the concept of sustainable development and people empowerment" (EO 234).

Development area

The GBDC's area includes the municipalities of Magsaysay, Medina, Talisayan and Balingoan and the city of Gingoog, all of which are located along the coast of Gingoog Bay (Figure 1). The bay has an irregular coastline of some 81 km and covers coastal waters of about 546 km^2 (GBDC 1996; MSU 2002). A total of 49 coastal barangays is found along the bay with some 3,200 fishers.

Organization and management

Originally, as mandated under EO No. 234 and amended under EO No. 300, the council is composed of the following: the Cabinet Officer for Regional Development as chair; the Secretary of the Department of Agriculture (DA) as vice-chair; and as members - the Executive Secretary of OP, the Secretary of the Department of the Interior and Local Government (DILG), the Governor of Misamis Oriental, the mayors

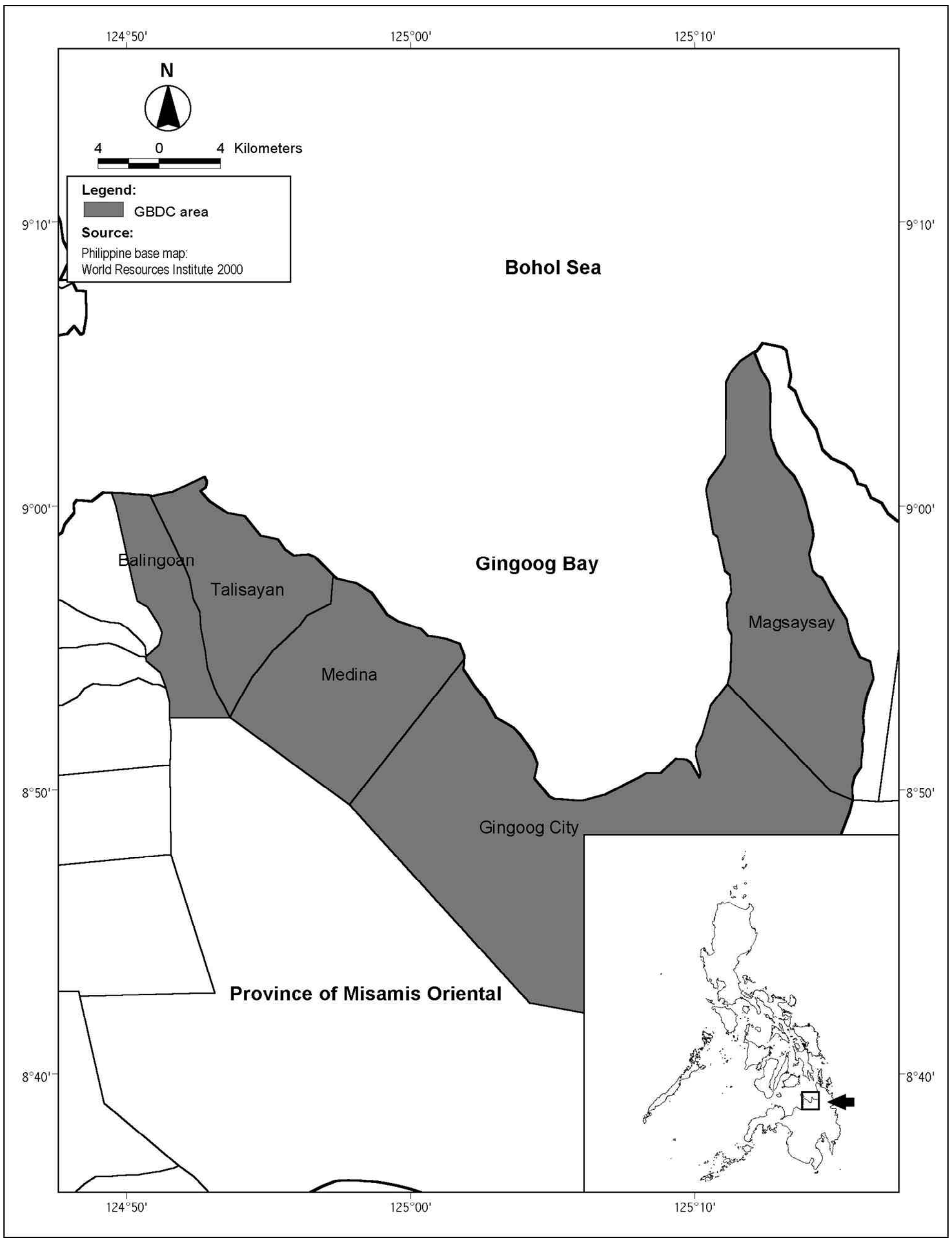


Figure 1. Location map of Gingoog Bay, Misamis Oriental, Philippines.

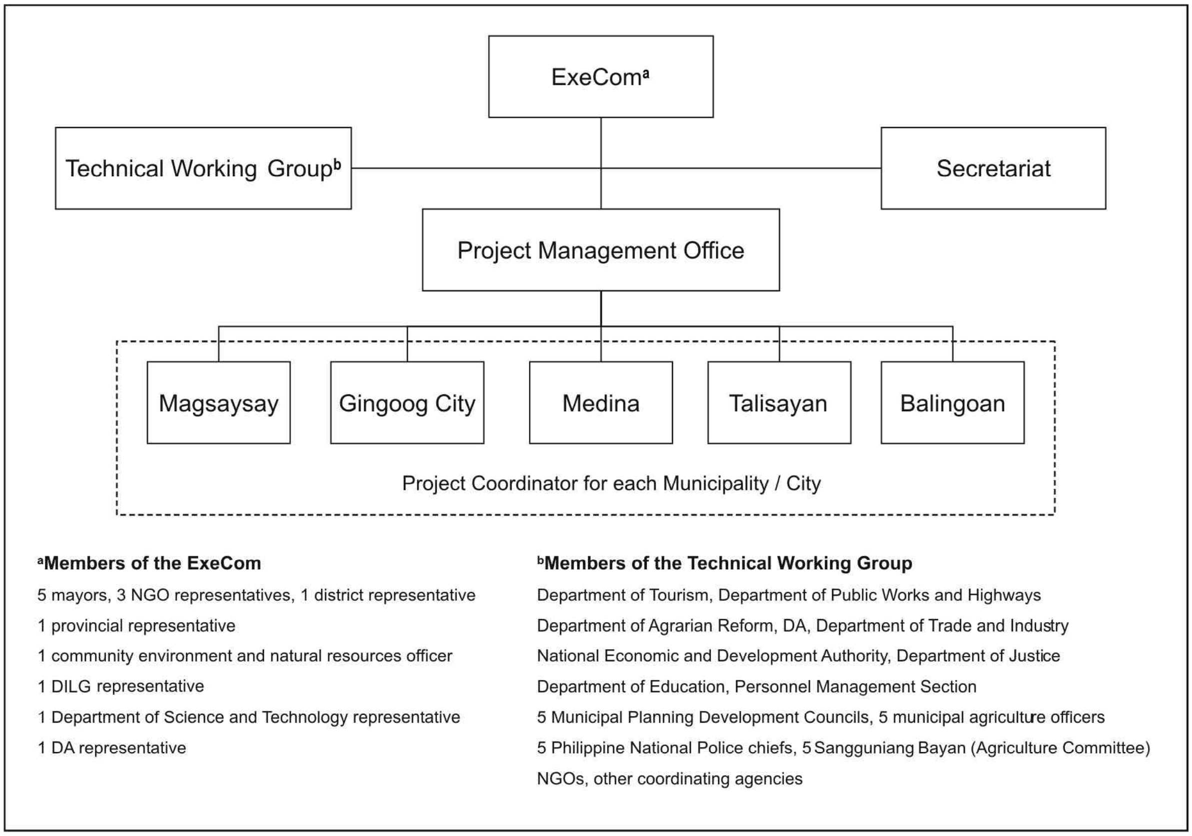


Figure 2. ExeCom structure of GBDC.

of concerned LGUs and three representatives from the private sector (one each from NGOs, fishing cooperative/fisherfolk or POs and agribusiness). However, the council has not met even once in such composition. The difficulty of organizing a meeting for the widely dispersed membership of the council led to the organization, by local decision, of an Executive Committee (ExeCom) composed of the five mayors in the area and local representatives from various sectors (Figure 2).

Henceforth, the ExeCom became the *de facto* policy and governing body of the council. A technical working group composed of specialists from different line agencies of the government and their local counterparts, as well as a secretariat assist the ExeCom. A Project Management Office, which also serves as clearinghouse for development projects in the area, carries out day-to-day operations.

Operational strategy

The GBDC, as an attached unit to OP, had an initial allocation from the national government of P5 million to support its operation in 1995. Only P300,000 was released through OP. Its allocation for the ensuing years was to be incorporated in the budget of OP. This funding support did not materialize due to problems between local politicians and OP. Nevertheless, to pursue the goals of GBDC, LGU members of the council have been contributing annually since 1996. The annual contributions are as follows: Gingoog City, P300,000, and P100,000 each from Medina, Talisayan, Magsaysay and Balingoan. The city of Gingoog, which has a larger internal revenue allotment, is the seat of PMO and serves as the conduit of the fund. The council now focuses its effort on establishing linkages with outside funding institutions to generate funds for its coastal resource management (CRM) projects. This is done in partnership with NGOs and line government agencies operating in the area.

Success through an integrated approach

The GBDC, with its NGO partners in the forefront, has gone a long way in organizing and mobilizing coastal communities along CRM. Some 57 fisherfolk associations, 56 cooperatives and 48 women organizations are found along the coastal stretch of Gingoog Bay in various levels of development (MSU 2002). All are involved in one way or another in interventions concerning CRM and in improving the quality of life of coastal dwellers. The following are some successful interventions in the area.

Resource enhancement and rehabilitation. The establishment of 12 fully protected, community-managed marine sanctuaries symbolizes the people's response to resource depletion and habitat degradation in the bay. Nine more protected areas are currently in the process of establishment, helped along by the success of the previous 12 sanctuaries, which were established up to eight years prior. The Magsaysay and Balingoan sanctuaries range from 4.5–21 ha and the total area of the marine protected area (MPA) in the bay is now over 106 ha. Fishers are now reaping considerable benefits from MPA in the form of fish production spillover.

Based on anecdotal research and community interviews, fish catch in waters near MPAs is reported to have risen from an average of 2 to 8 kg per four hours of fishing trip after three years since the MPA was established. The fishers observed that the establishment of sanctuaries not only has increased fish stock in their waters, but has also attracted more nonresident pelagic species.

With the guidance of NGOs in coordination with the Department of Environment and Natural Resources (DENR), fisherfolk associations have replanted around 120 ha of mangrove seedlings in the bay with a survival rate averaging 70%. Community-enforced regulations in selective mangrove harvesting (allowing trimming and cutting only) are being implemented in mangrove-rich communities like Poblacion, Santo Rosario, Magsaysay and Pangasihan-Talisay, Gingoog City. The rehabilitation has restored some of the nearshore productivity and has increased the nursery and feeding grounds of certain species of fish and crustaceans.

Surveillance and law enforcement. While the proposed baywide law enforcement team has yet to materialize, barangay-based *Bantay Dagat* (sea patrol) and civilian volunteer organizations have, nonetheless, been effective in reducing illegal fishing, such as blast fishing, use of fine mesh nets and fish poisoning. Community participation in guarding marine sanctuaries is also gaining ground. Watchtowers, mostly constructed from barangay and municipal funds (50-50 counterpart), attended by volunteer organizations, are now a common sight in coastal communities around the bay. Many of these are already equipped with searchlights and two-way radio communication systems. The approach, however, is more towards educating and warning possible offenders before they enter the sanctuaries rather than filing cases through local courts. Barangay authorities are averse to court litigation as this is expensive and time-consuming.

Putting an end to whale shark hunting. Whale shark (*Rhincodon typus*) hunting was a lucrative livelihood to some 30 families in Guiwanon, Talisayan, and Misamis Oriental from mid-1980s through late 1990s. Gingoog Bay and nearby waters became notorious as a killing field for the world's largest fish. The GBDC, with the able assistance of a private sector representative from Alibuag Resort in Balingoan, Mr. Rolando Uy, helped put an end to this practice. The DA-Bureau of Fisheries and Aquatic Resources finally stopped the capture of endangered species, such as whale sharks and devil manta rays, through the issuance of Fisheries Administrative Order 193 which banned their capture and sale.

The whale shark hunters were encouraged to develop ecotours in order to augment the income they lost from their former practice. The key fishers eventually became whale shark and dolphin watching guides. They were also given priority territorial use right to catch milkfish (*Chanos chanos*) fry in Guiwanon, Talisayan, and helped to culture milkfish in growout cages to supplement livelihood.

Income augmentation. LGUs, NGOs and POs focused on land-based income augmentation activities to reduce the reliance of families on the bay's resources. Coastal folks were trained on goat, swine and poultry production, and on contour farming of such cash crops as pineapples, beans, rice, bananas and vegetables. Livelihood assistance was also initiated through establishment of multipurpose cooperatives that aim to help local fishing communities. Some NGOs, such as the Mindanao Lumad Development Corporation (MILAMDEC) Foundation and Hagdanan sa Pag-uswag Foundation, even offered microcredit services patterned after the Grameen Bank of Bangladesh.[2] This project offers skills training and small credit facilities particularly to housewives so they can enhance household income. The funds came from Care Philippines, People's Credit Corporation and other funding institutions based in New Zealand, Australia and USA. Some were successful and others were not, but on the whole the local communities appreciated the interventions. Fishing families in Bonifacio, Magsaysay, who went into pineapple farming in their contour farms, as well as those who

[2] The concept is for borrowers to form a cell of five members to avail of a loan for such livelihood activities as fish and food vending, establishing a variety store, pedicab-for-hire and the like. The cell members are collectively responsible for loan payment performance of each. They are also encouraged to save parts of their income. Loan payment is weekly.

engaged in vegetable farming in Balingoan, disclosed that the livelihood opportunity has augmented their income significantly while minimizing their reliance on the sea.

Land management and reforestation. To integrate the whole ecosystem, upland communities in the Gingoog Bay development area were also organized along sustainable agriculture and agro-reforestation projects. Upland farmers were encouraged to plant hard woods and fruit trees to replenish lost forest cover in their respective farm lots. In Magsaysay, a cooperative was even contracted to plant trees by DENR under its reforestation project. This upland tree-planting project is expected to enhance the watershed of Gingoog Bay and curb soil erosion and siltation problems.

Waste management. The GBDC embarked on an integrated waste management project to address the worsening problem of waste in the coastal areas. The project is funded by the Philippine-Australia Community Aid Program. The concept of zero waste management is now being promoted in coastal barangays through trainings and seminars. The development of an environment-friendly waste disposal system (sanitary landfill) in each municipality or one in adjacent municipalities is the subject of a feasibility study also funded by Australian Aid and Canadian International Development Agency, with GBDC providing counterpart funding.

Lessons Learned

The Local Government Code of 1991 grants more powers and authority to LGUs to create and broaden their own sources of revenue. They may use their corporate power to engage in business or income-generating projects, or borrow money from or access external sources of funds to implement their development plans and programs. Likewise, the Fisheries Code of 1998 and the LGC of 1991 encourage inter-LGU alliances, given the fact that bays are a single ecosystem and their management is thus ideally done from a wider perspective. The GBDC proves that inter-LGU collaborations can be very effective mechanisms for CRM.

Local government alliances need to explore the same avenues in generating funds to implement their common projects. To remain dependent and hopeful on support from the national government is *passé*. In an era of decentralization, even a mandate from the national government on the creation of a local management body is not anymore a guarantee of success. Also, reliance on external sources (outside of the national government) does not result in certainty or sustainability. One of the key lessons learned by the council is self-reliance. In the end, it had to abandon its hope for government support and to realize that it has to dig deeper from its own reserve and the individual resources of the members to pursue its vision and goals.

However, one of the keys, if not the strongest, to the success of the council has been the partnership that it has forged with NGOs in the area. This partnership allows the council to pursue community-based coastal and upland projects, which otherwise could not have been done with its limited human and financial resources.

References

Adan, W.R. 2001. Institutionalization of alliances in Region IX and formulation of manual of operations. Project Terminal Report. Philippines-Canada Local Government Support Program, Region IX, Dipolog City, Philippines.

Garucho, R.D. 1997. Coastal resource management and local governance: A status report on local government support program interventions. Paper presented during the Regional Workshop on Integrated Management of the Coastal Zone, 26-27 June 1997, Makati City, Philippines.

GBDC (Gingoog Bay Development Council). 1996. Gingoog Bay area strategic development plan: 1997–2007. GBDC, Gingoog City, Philippines.

MSU (Mindanao State University at Naawan). 2002. Resource and social assessment of Gingoog Bay. Project Terminal Report. Fisheries Resource Management Project, Department of Agriculture-Bureau of Fisheries and Aquatic Resources, Quezon City, Philippines.

Fish Resource Assessment and Management Recommendations for Davao Gulf[1]

NYGIEL B. ARMADA
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo, 5023
Philippines

Introduction

The fishery resources of Davao Gulf (Figure 1) are shared by the provinces of Davao del Sur, Davao del Norte, Compostella Valley, Davao Oriental, Davao City and Island Garden City of Samal. Total annual landings by the capture fisheries sector from the gulf increased slightly from 18,000 t in 1987 to about 21,000 t in 1995. The increment was primarily due to increase in harvest by commercial fishing vessels, from 3,000 t in 1987 to 6,000 t in 1995. Landings by municipal fishers remained unchanged and their relative contribution has therefore declined.

Davao Gulf is a large waterbody of 3,087 km^2 and a wide-range of marine ecosystems support fisheries activities in its 17 coastal municipalities (Armada 2002). At present, management of the gulf is done independently by each local government unit (LGU). There have been isolated attempts, though, to integrate management initiatives among various localities in the gulf. Being a semi-enclosed body of water, Davao Gulf could be regarded as one marine ecosystem which is relatively easy to manage, unlike most other areas in the Philippine archipelago.

Fishing Activities

Estimates from a recent inventory showed a total of 13,930 municipal fishing crafts and 289 commercial fishing vessels (Armada 2002). A total of 115 commercial vessels (operated by 866 fishers) and 13,752 municipal boats (18,393 fishers) are directly used in fishing. Municipal fishers still make use of traditional fishing gears that have undergone very little modification. These are primarily the spear, scoop net, fish corral, barrier net, traps, pots, cast net, push net and beach seine. Some fishing gears, however, have evolved into species-specific fishing gears bearing specific names. Gillnets, for example, have been modified to catch specific target species. Bottom-set gillnets are designed to catch crabs and shrimps, such as *panglambay* and *pamasayan*, respectively, while drift or surface gillnets, such as *pambolinao* or *panamban*, are designed to catch anchovies and sardines, respectively. The same is true with hook-and-line fishing.

Davao Gulf has roughly 25 generic types of fishing gears which can be broken down further into about 200 specific types. Over 500 different fish and invertebrate species are caught in the gulf. Each municipal fishing boat has between two and four fishing gears. Usually, two fishing gears are carried on board during an operation. The most common gears used are the multiple hook-and-line, *pasol*, simple hook-and-line, squid/octopus jig, drift/surface gillnet and *palangre*/longline. The least commonly used gears include the hand spear, barrier nets, cast nets, crab liftnets, seine nets and fish corral. Beach seine, at an average of 26 kg/day, has the highest catch per unit effort (CPUE). This is followed by liftnet (17 kg/day) and push net (14 kg/day). The different traps and pots have the lowest CPUE, with averages of 2.4 kg/day and 2.9 kg/day, respectively (Armada 2002).

The commercial fishing crafts, on the other hand, were primarily operating bagnets, ringnets and purse seines. They are operated by 5 fishers each, on average. About 85% of this workforce is employed full-time. The estimated average catch per day of commercial outfits are 622 kg (for ringnet) and 59 kg (for bagnet).

---

[1] This paper can be cited as follows: ARMADA, N.B. 2004. Fish resource assessment and management recommendations for Davao Gulf, p. 332-335. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

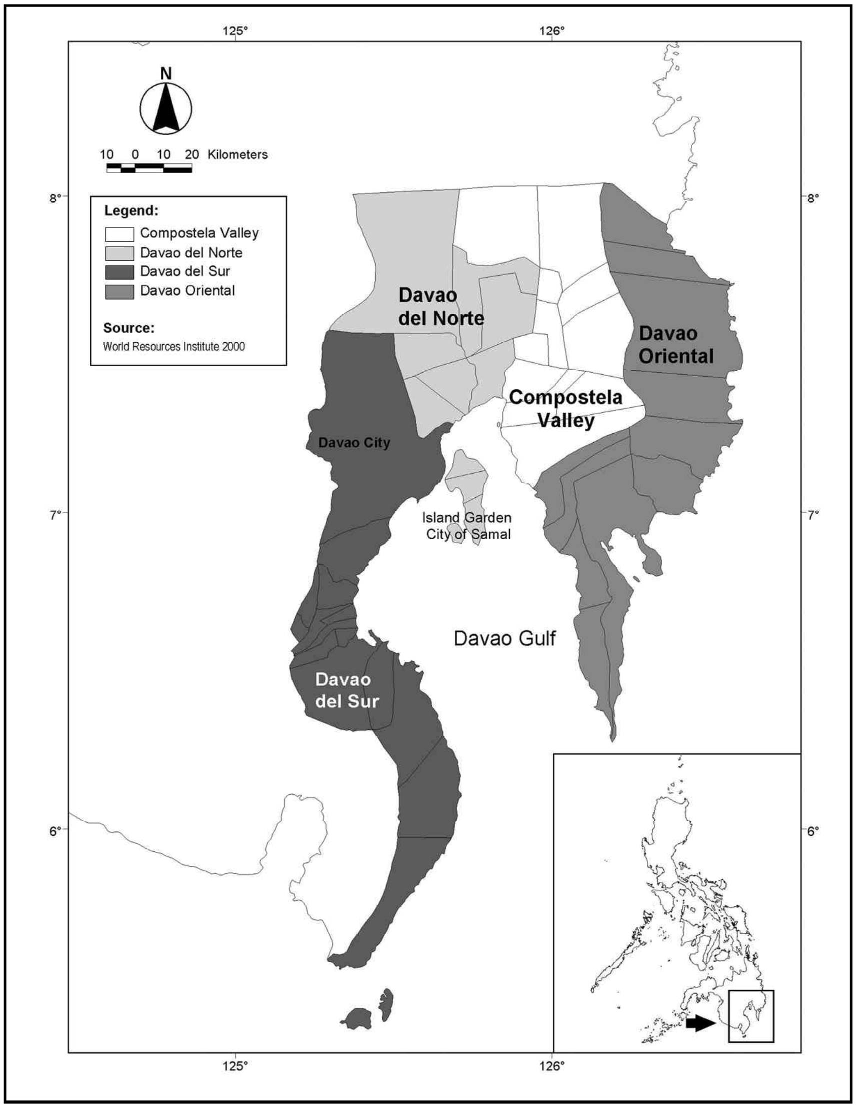


Figure 1. Davao Gulf and adjoining provinces , Philippines.

The estimated total annual landed harvest by all gears in 2001 amounted to 24,400 t, relatively higher than the 1987 and 1995 estimated landings (Figure 2). The multiple hook-and-line, being the most numerous, contributed 29.8% to total annual harvest, followed by ringnet (27%), simple hook-and-line and pole-and-line (11.7%), various hook-and-line types lumped under the local name *pasol* (10%), and drift and surface gillnets (6.6%). Also quite substantial were the contributions of squid and octopus jigs (4.8%), bagnet (3.6%) and surface set longline (1.9%).

Fish Stock Assessment

Population analysis was conducted on 8 of the most abundant fish species (Table 1), altogether, comprising over 60% of the total catch landed. All of the species showed high extraction rates (E), ranging from 0.58 to 0.70. Conventional theory suggests that optimal E values should be between 0.3 and 0.5 to be able to maximize biological

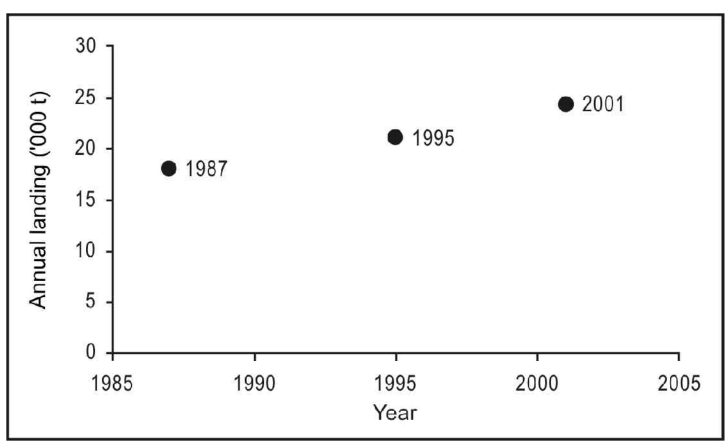


Figure 2. Total annual fish landings from Davao Gulf for 1987, 1995 and 2001.

yield (Gulland 1971; Beddington and Cooke 1983). Relative yield-per-recruit analysis (Beverton and Holt 1957) further confirmed that, with this mix of fishing gears and intensity of fishing effort, the current exploitation rates are already way above the maximum

Table 1. Population parameters for selected species in Davao Gulf, as estimated from catch monitoring data gathered from May 2000 to April 2001.

Species	Population Parameters					
	L_∞ (cm)	K (year^{-1})	Z (year^{-1})	M (year^{-1})	F (year^{-1})	E
Selar crumenophthalmus	26.5	0.85	4.10	1.66	2.44	0.60
Rastrelliger brachysoma	28.0	1.00	4.49	1.82	2.67	0.59
Rastrelliger kanagurta	28.5	1.30	5.96	2.15	3.81	0.64
Decapterus kurroides	39.0	1.15	5.43	1.82	3.61	0.66
Mene maculata	26.0	1.10	5.86	1.98	3.88	0.66
Auxis thazard	40.5	0.85	3.96	1.48	3.26	0.63
Auxis rochei	33.0	0.75	3.42	1.44	1.98	0.58
Siganus canaliculatus	29.0	1.25	7.01	2.09	4.92	0.70

Table 2. Important population parameters of selected species caught in Davao Gulf used for comparative assessments.

Species	L_∞ (cm)	E	E_{max}	L_{50} (cm)	L_{50}/L_∞
Selar crumenophthalmus	26.5	0.60	0.61	14.8	0.56
Rastrelliger brachysoma	28.0	0.59	0.54	11.9	0.42
Rastrelliger kanagurta	28.5	0.64	0.59	14.9	0.52
Decapterus kurroides	39.0	0.66	0.47	11.4	0.29
Mene maculata	26.0	0.66	0.55	11.6	0.45
Auxis thazard	40.5	0.63	0.49	11.8	0.29
Auxis rochei	33.0	0.58	0.52	14.4	0.44
Siganus canaliculatus	29.0	0.70	0.49	9.1	0.31

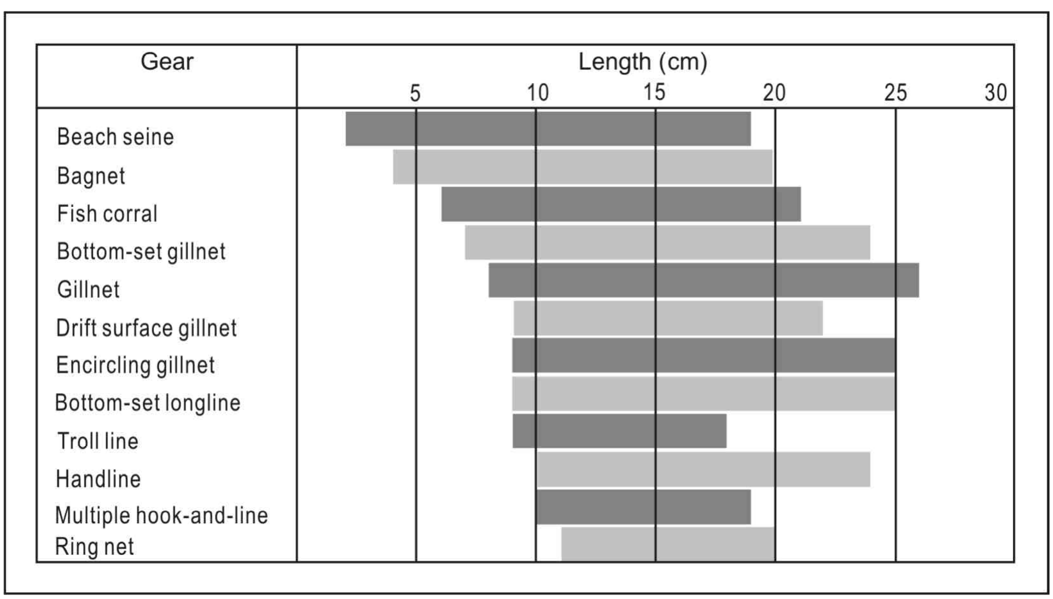
level for these species (Table 2). The ratio of relative length at first capture over the length at infinity (L_{50}/L_∞) indicates that, with the exception of *Selar crumenophthalmus* and *Rastrelliger kanagurta*, all other species investigated were already subject to high fishing intensity even during their early stages. This is primarily due to exploitation of relatively small individuals by beach seine, bagnet and fish corral (Figure 3).

Recommendations for Management

The current fishing pressure is quite high, and the annual level of harvest cannot be sustained. A moratorium on licensing of new crafts and gears is recommended to avoid displacement of existing fishers. However, it should not stop there. Results of stock assessment revealed that a number of fishing gear, namely, bagnet, beach seine and fish corral, were catching small individuals of most major species in the gulf or, simply said, are contributing tremendously to growth overfishing. These fishing gears are impacting negatively on the yield of the bay. There is a need to replace destructive fishing gears with nondestructive ones. Beach seine (both *sensuro* and *baling*), bagnet (*basing*) and fish corral (*bungsod*) have to be gradually replaced by hooks-and-lines and gillnets. A gear-swapping program should be initiated and designed to ultimately eliminate all destructive fishing gears.

A sustained information and education campaign as well as mechanism for awarding of government incentives should be set in place to encourage use of legal mesh sizes and nondestructive gears. Strengthening of fishery law enforcement capabilities

Figure 3. Length ranges of Indian mackerel (*Rastrelliger brachysoma* and *R. kanagurta*) caught by various fishing gears in Davao Gulf, May 2000 - April 2001.



of LGUs and consolidation of forces among their clusters will make enforcement agencies more visible in fishing grounds and discourage illegal fishing activities.

The current catch monitoring activities of the National Stock Assessment Project in the region should also be institutionalized. Collection and analysis of data should focus on biological reference points to monitor the effects of interventions (fisheries management measures, e.g., ban on certain fishing gears) on the stock. Estimation procedures used and parameters derived from this study can serve as bases for adjustments of allowable fishing effort. However, the estimation of benchmarks should be done every year, and the results regularly disseminated to stakeholders and resource users. This will sustain awareness and help refine procedures and estimates, while giving fisheries management interventions a scientific basis.

Complementary management measures

Control of fishing effort is one major intervention that is needed for the management of fish stocks in Davao Gulf. However, it is not enough. At the LGU level, a number of measures pertaining to restoration and protection of marine habitats of commercially important fish and invertebrate species should also be in place. There is a need to regulate fishing activities in reef areas and to disallow use of entangling nets, trammel nets and *hookah*, and allow only hook-and-lines and traps (Ingles 2002). Like elsewhere in the country, there is also a tendency towards indiscriminate establishment of marine protected areas (MPAs) in Davao Gulf for livelihood purposes (Ingles 2002) and simply to conform to government policies.

The establishment of a properly networked set of MPAs for the entire gulf is recommended to achieve the essence and function of a protected area (Nañola 2002). MPAs are likely to succeed in the gulf because of the presence of other habitats and the wide oceanic area where displaced fishers can go. There is also a need to conserve and protect existing mangrove communities and to consider the ecological and physical attributes in the rehabilitation of degraded mangrove areas (Flores 2002).

Fisheries and coastal habitat management can be orchestrated at various levels. An integrated coastal management plan and an implementation unit are needed for the entire Davao Gulf to provide policies and guidelines for sustainable exploitation of fish stocks, a basis for broad allocation of coastal resources, and reasons for the establishment and maintenance of a network of MPAs. LGUs need to focus on coastal habitat restoration, implement control of fishing effort, support responsible fishing practices and enforce fishery laws. These can be done by individual municipality, but forces can be consolidated by forming alliances among clusters of LGUs.

References

Armada N.B. 2002. Fishery resources assessment of Davao Gulf, Philippines, p. 1-33. *In* University of the Philippines-Visayas (UPV) Foundation. Resource and ecological assessment: Part 1. UPV Foundation, Iloilo, Philippines.

Beddington, J. and J. Cooke. 1983. The potential yield of fish stocks. FAO Fish. Tech. Pap. (242), 47 p.

Beverton, R.J.H. and S.J. Holt. 1957. On the dynamics of exploited fish populations. Fish. Invest., Ministry of Agriculture, Fisheries and Food, London. (2 Sea Fish.) 19, 533 p.

Flores, J. 2002. Status of mangrove ecosystem in Davao Gulf, Philippines, p. 83-117. *In* University of the Philippine-Visayas (UPV) Foundation. Resource and ecological assessment: Part 1. UPV UPV Foundation, Iloilo, Philippines.

Gulland, S. 1971. The fish resources of the oceans. FAO/Fishing News Books Ltd. Surrey, England.

Ingles, J.A. 2002. Status of coral reefs of Davao Gulf, Philippines, p. 35-72. *In* University of the Philippines-Visayas (UPV) Foundation. Resource and ecological assessment: Part 1. UPV Foundation, Iloilo, Philippines.

Nañola, C. 2002. Assessment of existing and proposed fish sanctuaries in Davao Gulf, Philippines, p. 73-83. *In* University of the Philippines-Visayas (UPV) Foundation. Resource and ecological assessment: Part 1. UPV Foundation, Iloilo, Philippines.

Ecoregion Fisheries Management: A New Approach to Address Biodiversity Loss Caused by Fisheries in the Sulu-Sulawesi Seas[1]

JOSE A. INGLES[2,3]
ROMEO B. TRONO[2]
[2]Sulu-Sulawesi Marine Ecoregion Program
World Wide Fund for Nature (WWF) - Philippines
LBI Bldg., 57 Kalayaan Ave., Diliman, Quezon City
Philippines
[3]Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas
Miagao, Iloilo, 5023
Philippines

Introduction

Ecoregions are large units of land or water that are biologically distinctive and harbor a characteristic set of species, ecosystems, dynamics and environmental conditions (Olson and Dinerstein 1998). Using these large biologically distinct areas as units of management is being undertaken by the World Wide Fund for Nature (WWF) to overcome constraints inherently present when using small area approaches. The ecoregion approach is currently being undertaken in one of the most biodiverse areas of the world, the Sulu-Sulawesi marine ecoregion (SSME). In SSME, capture fisheries overexploitation is considered one of the leading causes of biodiversity loss. A WWF program envisions that managing fisheries will help conserve the biodiversity of the region. This paper discusses the merits of using an ecoregional approach, a concept best suited to address fisheries and biodiversity conservation issues over large areas, particularly transboundary issues.

The Sulu-Sulawesi Marine Ecoregion

In 1998, the conservation organization WWF convened biodiversity experts and scientists from around the world to identify and map out large areas where biodiversity is threatened. These large units of land or water called ecoregions are biologically distinct areas that harbor characteristic set(s) of species, ecosystems, dynamics and environmental conditions (Olson and Dinerstein 1998). More than 200 areas around the world called the Global-200 have been identified and mapped out as ecoregions. Some 60 of these were high priority marine ecoregions, and one of these is SSME.

The geographic setting of SSME is unique as it includes portions of three countries, namely, Indonesia, Malaysia and the Philippines (Figure 1). The area includes 2 provinces of Indonesia (North Sulawesi and East Kalimantan), 10 coastal districts of Sabah, Malaysia (Kudat, Kota Marudu, Pitas, Sandakan, Kinabantangan, Beluran, Tawau, Lahad, Datu Semporna and Kunak) and 44 provinces of the Philippines.

Two large basins, the Sulu Sea and the Sulawesi Sea (Celebes Sea) with an aggregate area of almost 1 million km^2 comprise the ecoregion. The SSME is identified as one of the priority ecoregions for conservation, not only due to its high biodiversity and endemicity but also because of the seriousness of threats to its biodiversity caused mainly by fisheries-related activities.

Fisheries are an important economic activity in the area. Relative to the respective country's production, these are placed at 11% for Indonesia (Kahn and Fausi

[1]This paper can be cited as follows: INGLES, J.A. and R.B. TRONO. 2004. Ecoregion fisheries management: A new approach to address biodiversity loss caused by fisheries in the Sulu-Sulawesi Seas, p. 336-341. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

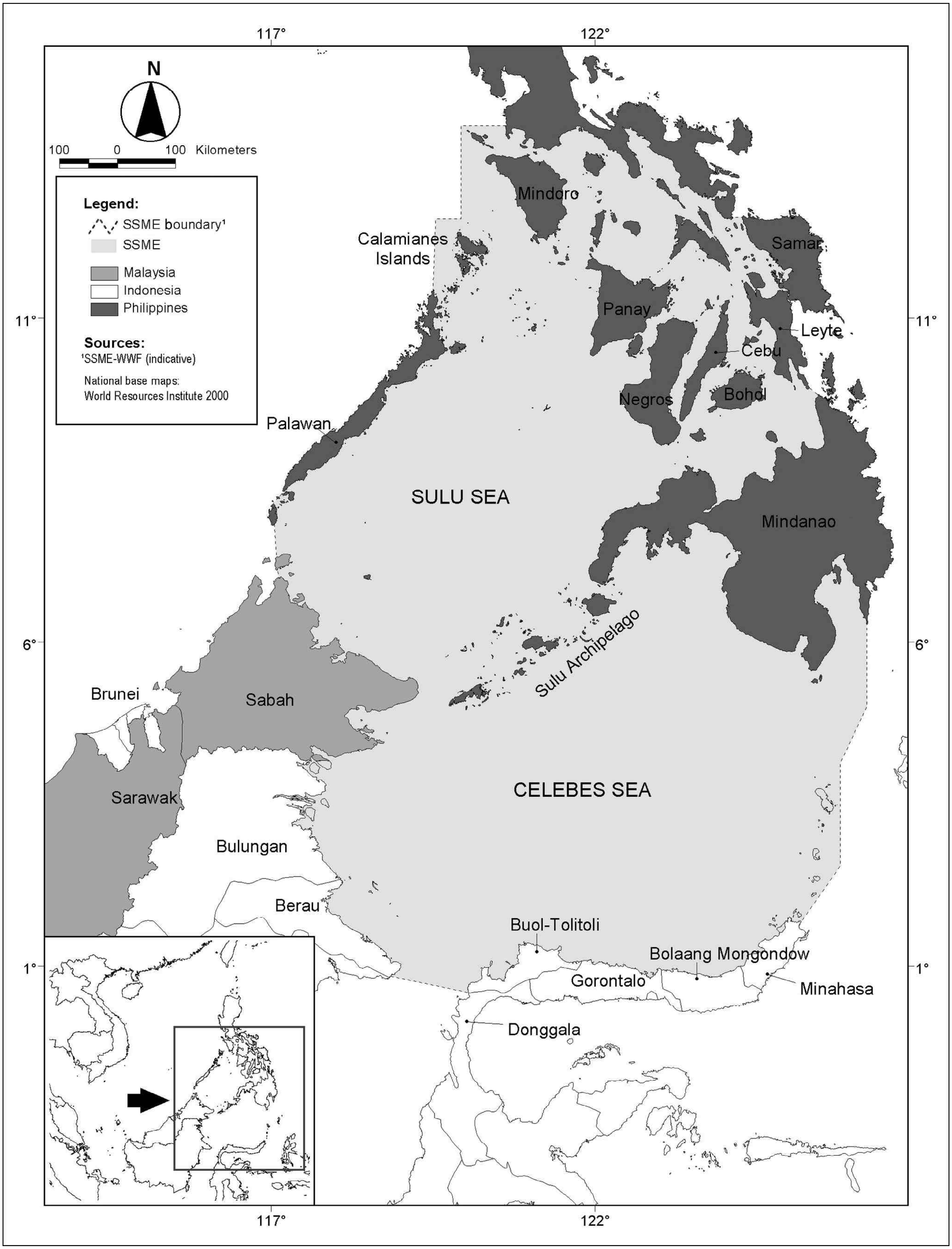


Figure 1. Geographic location of the Sulu-Sulawesi marine ecoregion.

2001), 15% for Malaysia (Biusing 2002) and 45% for the Philippines (Muñoz 2001). SSME's total fisheries production is around 1.8 million t, representing about 2% of the world's total fisheries output (Biusing 2002). An undetermined but significant portion of the 35 million people living along the coastal fringe is directly or indirectly dependent on the biological resources for livelihood (Cola 2001).

The sustainability of fisheries resources, however, is fast yielding to increasing and uncontrolled fishing activities, destructive fishing practices, lack of policies and weak or ineffective law enforcement regimes. This means that fishing, despite its economic importance, is one of the leading causes of biodiversity loss. If fisheries will be managed in a sustainable manner, biodiversity conservation will significantly improve.

Establishing an Ecoregional Fisheries Management Program

The establishment of a fisheries management program (FMP) for the ecoregion underscores the importance of fisheries as an economic activity in SSME. The overarching goal of FMP is to address proximate and long-term causes of biodiversity loss due to fisheries. Its general objective is to improve the condition of fisheries and their habitats through sustainable and collaborative management. The objectives of the program are to:

1. improve the status and management of fisheries in critical sites and marine protected areas;
2. develop and operate a mechanism to address transboundary fishery issues in SSME;
3. reduce illegal, unreported and unregulated fishing and other destructive fishing practices;
4. enable stakeholders to build their capacity in fisheries management;
5. increase public awareness on fisheries conservation;
6. generate and use information for better management of fisheries and their habitats; and
7. develop financing mechanisms for sustainable conservation and fisheries management.

The FMP is guided by four governing principles. First, it is stakeholder-based, i.e. all stakeholders are part of program formulation, planning and management. Second, it embraces an adaptive management strategy. This means approaches (e.g., ecosystem-based management) are tested, as they are deemed suitable based on scientific knowledge, and are constantly monitored and evaluated, with results fed back into the project management cycle. Third, the program adheres to the precautionary approach to fisheries management and works within the tenets provided by the International Plan of Action of the Food and Agriculture Organization, and the Code of Conduct for Responsible Fisheries. Lastly, as a working principle, the role of WWF is to serve as catalyst for change, providing advisory assistance, both technical and scientific, and to help governments and institutions achieve their goals of sustainable fisheries use.

Central to the successful implementation of SSME FMP are three core activities: (1) determination of the state of fisheries and management regimes in the area; (2) development of an ecoregional fisheries framework that is compatible with the existing framework of the three countries; and (3) establishment of an institutional mechanism to implement the program at the ecoregion level while effectively linked with national and local site programs.

Country reports and fisheries studies were commissioned to achieve the first core activity. These validated existing information and identified knowledge gaps, particularly those on priority fisheries issues and problems.

The development of the fisheries framework involved four sequential activities (Figure 2). First is the drafting of the framework strategy and objectives by a seven-member core team composed of fisheries experts and focal persons from each of the three countries. The next three steps involved the participation of key stakeholders. After reviewing the status and management of fisheries in SSME and validating the issues, the stakeholders ratified the draft framework strategy and objectives. Finally, they formulated the SSME FMP. These activities were undertaken during the First Regional Stakeholders' Workshop held in early 2002 in Manado, Indonesia.

While the task of framework development was straightforward, the work towards the creation of an institutional mechanism involved a complex diplomatic process among the three countries. Envisioned for SSME was a tri-national working group in fisheries which will serve as a steering body to act on fisheries matters of transboundary nature. To overcome the monumental task of establishing a new regional body, an existing one with a fisheries agenda was found to be the best institution to work with. The Brunei Darussalam, Indonesia, Malaysia and Philippines East Asian Growth Area (BIMP-EAGA) was chosen as the key platform upon which the trinational group would be formed. The choice of BIMP-EAGA was ideal for three reasons: it already deals with fisheries trade matters; it encompasses the Sulu and Sulawesi Seas; and three of the four country-members are part of SSME.

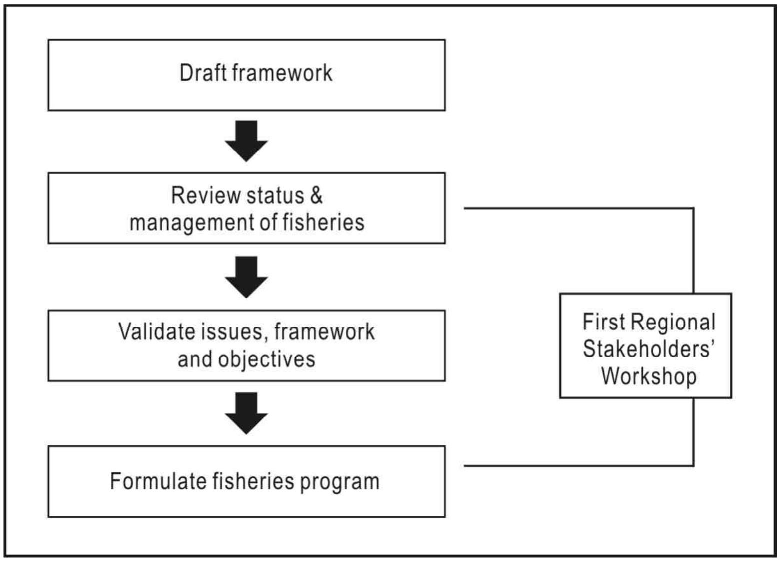


Figure 2. Framework development process of SSME FMP.

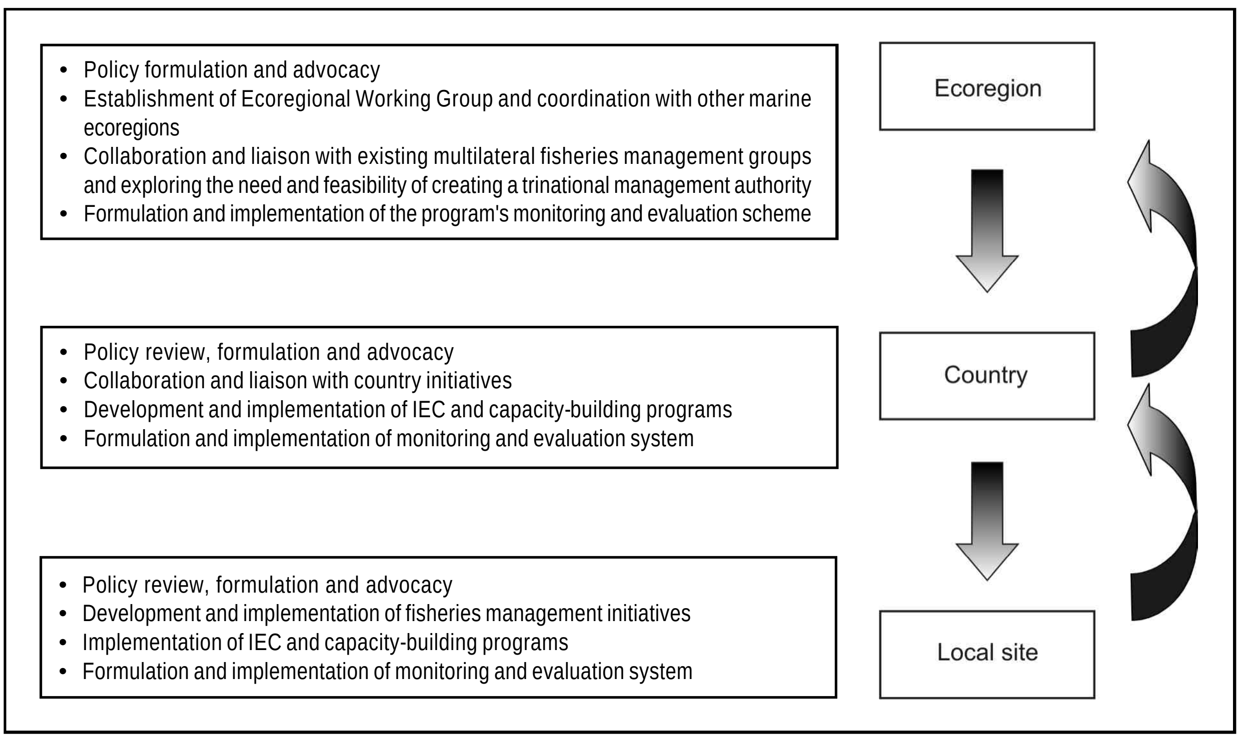


Figure 3. Delivery mechanism of SSME FMP.

Delivery mechanism

While SSME FMP is regional in scope, activities and interventions are initiated (Figure 3) at the local, national (country) and regional (ecoregional) levels. Development and implementation of fisheries management initiatives are more at the local level. Common to all three levels are policy review, formulation and advocacy, information, education and communication (IEC) programs, and monitoring and evaluation of all initiatives in the respective countries. The task at the ecoregional level is to coordinate and liaise with the three countries on transboundary issues and initiatives.

The ecoregion as an approach to management

The use of a stakeholder-grounded framework gave the element of flexibility for the program to fit into existing fisheries frameworks of the countries.

Table 1. Fisheries issues requiring transboundary actions as identified by stakeholders.

Issues	Indonesia	Malaysia	Philippines
Shared stock management			
Shared stocks (yellowfin, dolphin, finfish, anchovies, elasmobranchs, cephalopods, shrimps, lobster, other crustaceans)	X	X	X
Lack of tri-national institutional mechanism (e.g., Working Group, discussion with BIMP-EAGA)	X	X	X
Transboundary fishing operations	X		X
Lack of coordination and joint operation in enforcement	X	X	X
Trade issues, such as live fish marketing; market forces management; influx of raw supply; seaweeds; crustaceans; mollusks; dried, chilled, fresh products; nonexistence of common standards	X	X	X
Fish quarantine and disease introduction to fish stocks		X	X
Human migration	X	X	X
Fish for food security or income (mariculture)			
Culture of carnivores using fish	X		X
Transshipment in live fish trade	X	X	X
Grow-out type of culture (e.g., groupers, Napoleon wrasses, lobsters)	X	X	X
Impact of mariculture on marine environment			X
Role of gender and development in fisheries	X	X	
Illegal, unreported and unregulated fisheries			
Environmentally destructive fishing methods (e.g., use of explosives, toxins, ghost fishing)	X	X	X
Intervention to improve monitoring of fisheries	X	X	X
Statistics for management purposes	X		X
By-catch	X	X	X
Health hazard in fishing	X	X	X
Encroachment in national waters of foreign fleets		X	
Marine debris (e.g., fish aggregating devices, drift gillnets)			X
Post-harvest and marketing			
Value added, processing	X	X	X
Quality control	X	X	X
Quality standards	X	X	X
Certification of fishery products	X		X
Network of no-take zones/protected areas			
Fish spawning aggregations	X	X	X
Fish corridors	X		X
Lack of understanding and appropriate management of marine corridors	X		X
Limited to national effort	X	X	
Economic instruments in fisheries development			
Role of subsidies in fisheries in SSME	X		X
Licensing agreements in fisheries	X		X
Enforcement issues			
Effectiveness of enforcement initiatives	X	X	X
Lack of coordination/joint patrolling	X	X	X
Legal loopholes	X		X
Monitoring and surveillance	X	X	X
Lack of capacity	X	X	X
Lack of awareness on fishery issues	X	X	X
Research and information management			
Lack of reliable data and information sharing (e.g., bioreproduction, population dynamics, stock abundance)	X	X	X

This broad-based approach has circumvented probable limitations of other approaches (e.g., community-based management) that are already used in the area. A stakeholder-based program fits well into current government thrusts and programs and is unlikely to run counter to any government initiative.

One of the primary advantages of using the ecoregional approach is that it manages fisheries from a much larger perspective and scope, similar to other large-scale approaches to management such as bioregions and large marine ecosystems. It tries to manage fisheries beyond national jurisdictions and cover the whole geographic range of particular populations of concern or include set or sets of critical habitats. The ecoregional approach is ideal for issues that may be national yet require solutions that are supranational in level, such as addressing IUU (illegal, unreported and unregulated) fishing and live food fish trade (Table 1). It also provides the venue to address transboundary fishery issues which traverse national boundaries and where solutions require complementary actions from more than one government or the region. Transboundary concerns include IUU fishing and illicit trade of noxious substances used in fisheries.

Conclusion

The FMP is one of the key projects implemented under the SSME Program, which draws its mandate from the Ecoregion Conservation Plan that was recently endorsed by representatives of the governments of Indonesia, Malaysia and the Philippines.

However, fisheries management on an ecoregion scale has its drawbacks. It would have to contend with a very large area, with the dynamics of large multicultural, highly diverse stakeholders, each with its own agenda to pursue and, depending on the ecoregion, the number of governments to deal with. Problems inherent to managing large areas, such as inadequate communication facilities and language gaps, are also present.

Taking all these factors into consideration, the success of the program depends highly on the stability of the political climate, i.e., the harmonious relationship among countries that comprise the ecoregion. Even a single non-fishery issue between countries could halt or worse, even negate all past achievements. Focus needs to be on strategic issues of mutual concern.

Given this situation, the most difficult hurdle of the program is the establishment of a mechanism to address fisheries concerns at the ecoregion level. The BIMP-EAGA was identified as the best platform for this endeavor. Through BIMP-EAGA, SSME-FMP can instill awareness of governments about the significance of ecoregion-based fisheries management and can help develop partnerships with the private sector.

Fisheries management at the ecoregion level is an untested approach. The recent successes however of the Multilateral High Level Convention on Management and Conservation of Migratory Species in the Western and Central Pacific (mostly for tuna) and the unique collaboration between the Philippine and Malaysian governments towards management of the Turtle Islands provide a strong precedent upon which to build FMPs in larger marine ecosystem contexts.

References

Biusing, R. 2002. Fisheries of Sulu-Sulawesi Seas: Malaysian country report on the assessment of the state of fisheries of Sabah, Malaysia. World Wide Fund for Nature - Philippines Sulu-Sulawesi Marine Ecoregion Program, Quezon City, Philippines. 178 p.

Cola, R. 2001. People of the cross current: Social profile of the Sulu-Sulawesi marine ecoregion. Final report. World Wide Fund for Nature - Philippines Sulu-Sulawesi Marine Ecoregion Program, Quezon City, Philippines. 107 p.

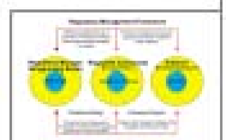
Kahn, B. and A. Fauzi. 2001. Fisheries of Sulu-Sulawesi Seas: Indonesian country report on the assessment of the state of biophysical, socio-economic and institutional aspects of coastal and pelagic fisheries in the Indonesian part of SSME. Final report. World Wide Fund for Nature - Philippines Sulu-Sulawesi Marine Ecoregion Program, Quezon City, Philippines. 148 p.

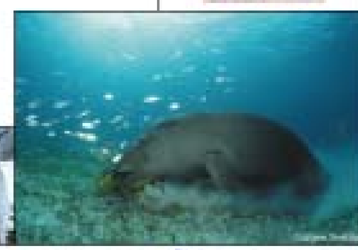
Muñoz, J. 2001. Fisheries of Sulu-Sulawesi Seas: Philippine country report. World Wide Fund for Nature - Philippines Sulu-Sulawesi Marine Ecoregion Program, Quezon City, Philippines. 78 p.

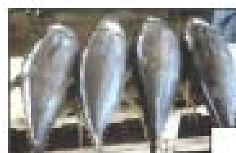
Olson, D.M. and E. Dinerstein. 1998. The global 200: A representation approach to conserving the earth's most biologically valuable ecoregions. Conserv. Biol. 12: 502-515.

SECTION V

Conclusion and Recommendations







Sustaining Philippine Marine Fisheries Beyond "Turbulent Seas": A Synopsis of Key Management Issues and Opportunities[1]

CESAR Z. LUNA
GERONIMO T. SILVESTRE
MARCIANO F. CARREON III
ALAN T. WHITE
STUART J. GREEN
Tetra Tech EM, Inc.
Coastal Resource Management Project
5th Floor, CIFC Towers
North Reclamation Area, Cebu City 6000
Philippines

Introduction

The preceding chapters provide detailed reviews covering various aspects of Philippine marine fisheries. Collectively, the contributions describe a wide range of issues and problems that impact the sector. Possibilities for remedial action are also suggested, particularly in the contributions covering policies and management tools. In this last section, we review the relevant facts from the various contributions and take an integrative view of coastal resources with a focus on marine fisheries. Our objective is to identify critical actions to steer the marine fisheries sector towards a path of sustainability.

In sketching the path towards sustainable marine fisheries, we begin by reviewing its status, focusing on the issues and opportunities in this sector. After describing Philippine marine fisheries at present, we point to where it needs to go and present the strategic objectives of fisheries management and thereby define what we mean by sustainable marine fisheries. Finally, we present six critical actions to achieve the fisheries management objectives.

Key Issues in Philippine Marine Fisheries

The contributions in this profile are all fairly consistent in highlighting certain issues and trends in the coastal resource and fisheries sector. The consensus is that Philippine marine fisheries today are characterized by the following:

1. depleted fishery resources;
2. degraded coastal environment and critical fisheries habitats;
3. low catches/incomes and dissipated resource rents;
4. physical losses and/or reduced value of catches due to improper post-harvest practices and inefficient marketing;
5. inequitable distribution of benefits from resource use;
6. intersectoral and intrasectoral conflicts;
7. poverty among small-scale fishers; and
8. inadequate systems and structures for fisheries management.

The first 2 issues are biophysical impacts, issues 3-4 are economic in nature, issues 5-7 are social, and the last issue is institutional. Below we examine these characteristic issues.

Depleted fishery resources

In general, the various types of marine fishery resources of the country—reef fishery resources, invertebrates, demersals and small pelagics—are

[1] This paper can be cited as follows: LUNA, C.Z., G.T. SILVESTRE, M.F. CARREON III, A.T. WHITE and S.J. GREEN. 2004. Sustaining Philippine marine fisheries beyond "turbulent seas": A synopsis of key management issues and opportunities, p. 345-358. *In* DA-BFAR (Department of Agriculture-Bureau of Fisheries and Aquatic Resources). In turbulent seas: The status of Philippine marine fisheries. Coastal Resource Management Project, Cebu City, Philippines. 378 p.

biologically overfished, often severely in traditional nearshore fishing areas. In the case of demersals, biomass levels are today only 10-30% of the levels in the late 1940s. Fishing has resulted not only in greatly reduced demersal biomass but also in shifts in species composition that include, among others, the general decline of larger-sized and commercially valuable species. The latter indicates profound changes in the ecosystem (Armada, this vol.; Silvestre and Pauly, this vol.; Barut *et al.*, this vol.). For small pelagics, by the 1980s, the level of fishing effort was already twice the magnitude necessary to harvest maximum sustainable yield (Barut *et al.*, this vol.) while the average catch rate during the same period was only one-sixth of the rate in the 1950s (Zaragosa *et al.*, this vol.). In reef fisheries, the catch rates that have been documented recently are among the lowest in the world (Aliño *et al.*, this vol.).

Figure 1 shows the factors that result in depletion. The primary reason for the widespread depletion is the lack of access controls that tends to induce more fishing until catch rates become unprofitable. While some fisheries may take decades to reach the point of biological overfishing, for other fisheries boom and bust cycles are not uncommon. Examples include fisheries for blue crabs, sea urchins and other less mobile invertebrates (Juinio-Meñez, this vol.). The latter are particularly vulnerable to overharvesting since little or no fishing implements are required for their collection. Typically, the fishery expands rapidly, sometimes in response to an export market. Once resources are fished down, buyers and processors move on to other areas where the cycle begins anew. As Juinio-Meñez (this vol.) noted, the events that led to the collapse of the sea urchin fishery in Bolinao are probably a common pattern of invertebrate exploitation elsewhere in the country.

Often closely related with excessive fishing is the harvesting of immature fish. This practice has two major consequences: (1) fish are caught before they attain sizes that would maximize physical yield and command higher prices, thus reducing the weight and value of

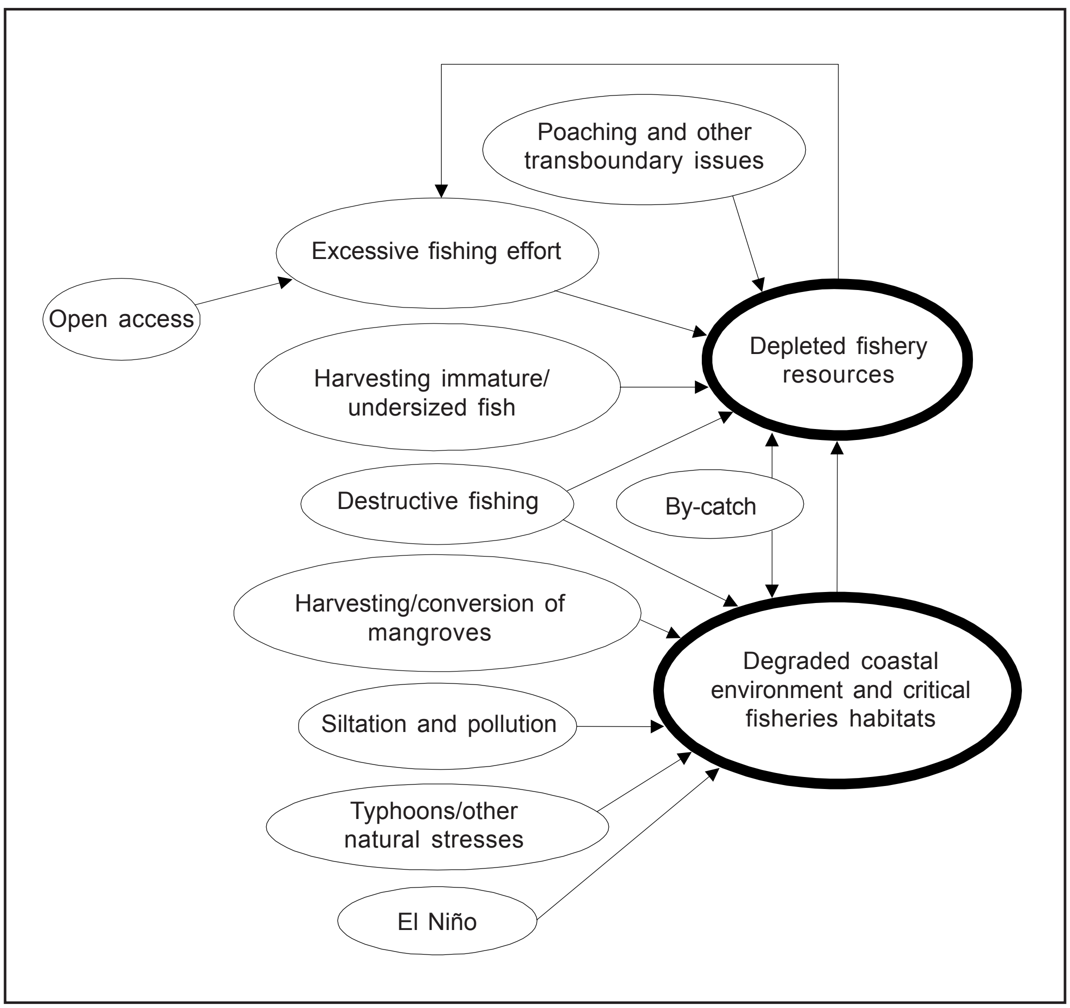


Figure 1. The factors leading to the depletion of fishery resources and the degradation of coastal environment and critical fisheries habitats.

the catch accruing to the producer (fisher) and the consumer; and (2) the number of individuals entering the parent stock is reduced and consequently, populations of succeeding generations tend to decrease progressively (Armada, this vol.). Ingles (this vol.) provides an example in the crab fisheries, noting that from one-fourth to one-third of crab gillnets and crab pots caught immature individuals. More disturbing, however, is the intentional targeting of immature fish, such as local fisheries for juvenile siganids (*padas*) (Hermes, this vol.). Fishers also target juvenile tunas in *payaos* (Babaran, this vol.; Zaragoza *et al.,* this vol.). Likewise, in certain areas, immature groupers are targeted for the live reef food fish trade (Mamauag, this vol.).

Fishing results in by-catch, which may comprise a considerable portion of the catch if nonselective gears are used (as is often the case in the country). In fry gathering for aquaculture, which is a problem in itself because it targets fish larvae, the push nets used also collect nontarget species that are discarded. The impact of fry gathering on local diversity has not been studied but is probably considerable (Hermes, this vol.). In the Visayan Sea, the by-catch of crab gillnets can be as high as 45% of the catch, with a considerable amount relegated to discards (Ingles, this vol.). The unintentional catching of endangered marine mammals by drift gillnets and other gear is one of the most significant threats to their existence (Alava and Cantos, this vol.).

As discussed below, the coastal environment is degraded in many areas of the country. Degraded habitats impact the quantity and quality of harvestable resources. Other reasons for depleted resources include destructive fishing, such as the use of poisons, nearshore trawling and explosives as well as increasing pollution from shoreline development and upland runoff, physical damage from boats among other causes. Near the country's boundaries, poaching and other transboundary issues can also contribute to the problem (Ingles and Trono, this vol.; Villena and Pido, this vol.).

Degraded coastal environment and critical fisheries habitats

Coastal habitats, such as mangroves, seagrass beds and coral reefs, are degraded in many areas of the country. Less than a third of mangroves remain of the original 450,000 ha in 1918. Today 95% of the remaining mangroves are secondary growth of much lower quality. Between 230,000 ha and 260,000 ha of mangroves were lost to fishpond conversion before it was banned in 1980. Harvesting of mangroves for fuelwood and charcoal, however, still continues (White and de Leon, this vol.).

With regard to seagrass beds, it has been estimated that about half were lost or severely degraded during the past 50 years. It is projected that a significant portion of the remaining seagrass beds will be lost in the next decade or two from increasing shoreline development and its impacts (Fortes and Santos, this vol.).

In the early 1990s, a survey of 85 coral reefs indicated that half of the sites had less than 50% live coral cover while about a quarter of the sites had less than 25% live coral cover (Gomez *et al.* 1994). Fishing practices that are particularly destructive to corals include blast fishing, reported in almost every fishing ground in the country, and the use of poisons. Ochavillo *et al.* (this vol.) note that about 70% of ornamental fish are caught with cyanide. Poisons are also used to catch certain juvenile fish (Hermes, this vol.) and fish for the live fish food trade (Mamauag, this vol.).

Other factors that impact on the coastal environment and impede its ability to support fisheries that are not directly related to fishing are shown in Figure 1.

Low catches/incomes and dissipated resource rents

Depleted fishery resources and degraded habitats have led to low catches and incomes for fishers. According to fisheries economics theory, fisheries that are biologically overfished are necessarily economically overfished as well, with aggregate "profits" or resource rents (total revenues less total costs including opportunity costs of labor and capital) either close to zero or considerably less than what they could be. In the fisheries described earlier, the total economic resources expended on fishing can be reduced considerably to obtain the same or even higher level of catch. Thus, fisheries that are biologically and economically overfished represent continuing losses for the marine fisheries sector and for the country as a whole. Annual rent dissipation in the demersal and small pelagic fisheries has been estimated at US$130 million and US$290 million, respectively (Barut *et al.*, this vol.). While the dissipation of resource rents describes the situation for an entire fishery, at the level of individual fishers, rent dissipation translates to greatly reduced incomes and poverty among fishing communities.

Physical losses and/or reduced value of catches due to improper post-harvest practices and inefficient marketing

Fish, once caught, must be handled properly to retain market and nutritional value. Improper handling can lead to spoilage, which will render fish unfit for human consumption or reduce its value. On the average, about 25-30% of total catch is lost due to improper handling (Espejo-Hermes, this vol.). Inadequate cold storage and poor roads contribute to the inefficient marketing of fish and the consequent reduction in their value. Inefficiencies in marketing also result from economic—as opposed to purely physical—factors. Many intermediaries are typically involved in the marketing of fish. This suggests that price information does not flow freely to fishers (Santos, this vol.).

Inequitable distribution of benefits from resource use/ intersectoral and intrasectoral conflicts

In many areas, commercial and municipal fishers are locked in an intense competition for nearshore fishery resources. Although current laws prohibit commercial fishing within 15 km from the shore, compliance with the laws is still very limited. First, most commercial fishing boats are not large enough to operate beyond 15 km and the common fishing gears they use (e.g., trawl, ring net and purse seine) are unsuitable for such depths. Second, although there is little information about fishery resources beyond 15 km, it is reasonable to assume that there are not many additional resources since tropical fisheries tend to be concentrated in shallow depths. Third, the lack of enforcement capabilities in many areas suggests that at most commercial fishers have become hesitant, but not deterred, from operating in nearshore areas where the likelihood of catching fish is higher. Thus, the intense competition between municipal and commercial fishers in nearshore fishing grounds is likely to continue.

This nearshore competition often intensifies into conflicts. In trawlable areas, for example, the dragging and destruction of municipal fishers' gillnets by commercial trawlers are a common occurrence that precipitates conflict. Inequity in the distribution of catches between commercial and municipal trawlers is expected given the fishing power utilized in commercial operations. Such inequity has been documented in many fishing grounds. The observations of Silvestre and Pauly (this vol.) in San Miguel Bay, though dated, is illustrative:

> "The trawlers, consisting of 89 units and belonging to only 40 households, obtain 85% of pure profit, 42% of catch value and 31% of the total catch. The rest goes to 2,300 small-scale fishing units owned by 3,500 households and employing about 5,100 fishers."

The obvious consequence of this gross inequity is greatly reduced incomes for municipal fishers. The inequity also makes for a highly emotional issue that often polarizes the two sides as well as their respective supporters in government, nongovernment organizations and the academe. Increasingly, it becomes difficult to bring the two parties together in an atmosphere of principled negotiations where both parties can explore possibilities of mutual gains.

Poverty among artisanal fishers

The depletion of fishery resources has led to very low catch rates. One estimate places the average catch of a municipal fisher at 2 kg per day, down from 20 kg per day in the 1970s (Israel, this vol.). Despite such low catch rates and consequent low incomes, fishers have few alternatives to fishing and thus continue the activity to survive. Post-harvest losses and inefficient marketing exacerbate the problem (Figure 2). With these factors combining to reduce incomes of small fishers, it is not surprising that poverty among artisanal fishers is widespread. An estimated 80% of fishers are said to live below the poverty threshold (Santos, this vol.).

Various authors explain how poverty among artisanal fishers is not caused solely by factors within the fisheries sector. In the fisheries "system" framework presented in Section I, we emphasized that the marine fisheries exist within the country's larger socioeconomic development context, which is itself characterized by generally low productivity, high unemployment and underemployment, rapidly increasing population and widespread poverty. As long as the Philippine economy remains in this state, the marine fisheries will continue to absorb excess labor from other sectors. Thus, although measures within the fisheries domain to alleviate poverty among fishers must be undertaken, these will have a limited effect and cannot solve the larger problem of poverty and unemployment. The ultimate solution to poverty among fishers lies outside (and inside) the fisheries sector.

Inadequate systems and structures for fisheries management

The Philippine government has inadequate capacity to manage fisheries on a sustainable basis. At the minimum, the sustainable management of a fishery requires: (1) a system to monitor fish stocks and determine sustainable catch levels on an annual basis, and (2) a system to control the amount of fishing so that it does not exceed such sustainable levels. Furthermore, the two systems must be linked so that

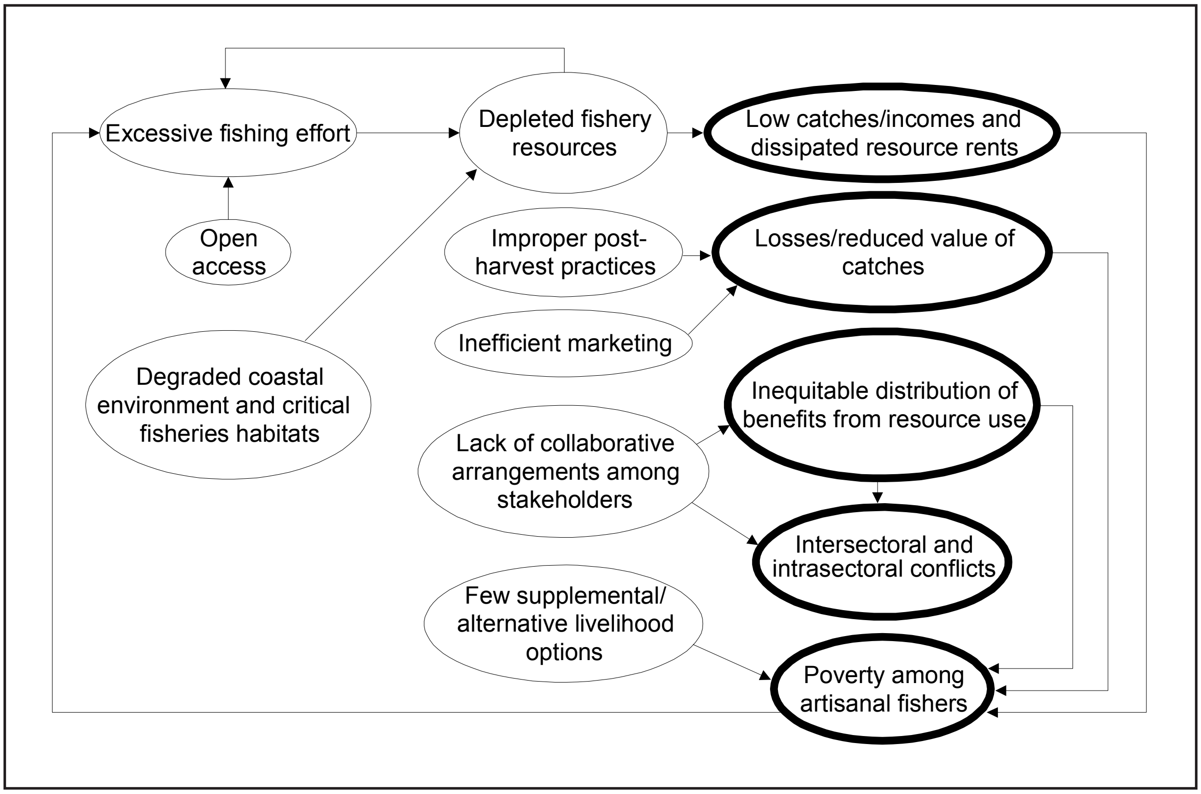


Figure 2. The economic and social issues in marine fisheries, which are driven in part by degraded coastal environment and depleted fishery resources. Note how most issues ultimately contribute to perpetuating poverty among artisanal fishers.

information from the first feeds directly into the second. With regard to the first element, there are attempts to establish continuous monitoring of fish stocks in particular areas under the National Stock Assessment Program (Carreon, this vol.) and the Fisheries Resources Management Project of the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR). At best, such efforts are in their infancy and their continued existence is in doubt. Yet the more important concern relates to our serious inability to control the amount of fishing through effective localized management.

At both national and local levels, the main characteristics of our present systems for fisheries management are as follows:

- inadequate policies for fisheries and coastal resource management (CRM);
- weak interagency coordination and weak law enforcement; and
- inadequate human resources and capacity, infrastructure and equipment (Figure 3).

As examples of inadequate fisheries policies, we can cite the limitations of the Fisheries Code discussed by Santos (this vol.), the national government's promotion of *payaos* (Babaran, this vol.) and the lack of clear policies on capture fisheries for larval and juvenile fish (Hermes, this vol.). Sometimes, the information that should have informed the policy process is insufficient or absent. In other cases, information that has been available for years has been ignored by policymakers. Such is the case, for example, with demersal stocks where clear evidence of overexploitation was presented as early as the 1960s (Armada, this vol.).

In contrast to other countries that have one agency to enforce fisheries laws, the Philippines has several agencies charged with this function, and they often operate without protocol for enforcement response (Guidote, this vol.). There is also significant reliance on the *Bantay Dagat* (sea patrol) or volunteer groups with their predictable limitations (Trudeau, this vol.).

Local governments units (LGUs), which have been given the responsibility to manage fisheries in their localities, are limited by inadequate human resources, infrastructure and equipment. The situation with national agencies like BFAR, which should support local governments, is not much different. The primary reason is inadequate funds as well as efficient and effective operating systems within the agencies concerned. Funds for fisheries management are inadequate not only because the country is poor but also because low priority is given to fisheries relative to other concerns of the government, especially within DA.

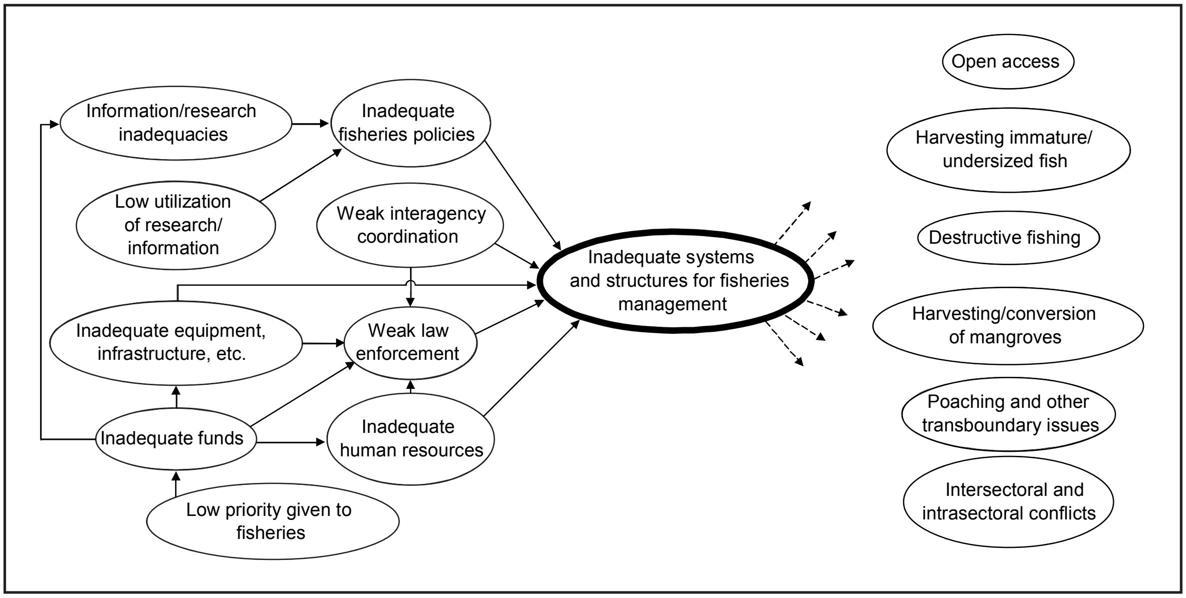


Figure 3. The overall features of the present systems and structures for fisheries management. Inadequacies in these systems ultimately lead to an inability to control access to the resources, prevent destructive and inappropriate resource use, and minimize conflicts among resource users.

The interconnected issues

Figure 4 shows the interconnections among the issues described above. The eight issues characterizing Philippine marine fisheries today appear with darkened outlines on the right side of the diagram while their causes generally appear on the left. The main interconnections among the issues described earlier are worth reiterating:

- Open access ensures that levels of fishing effort will be excessive, which leads to depleted fishery resources.
- Degraded coastal environments and critical fisheries habitats exacerbate the depletion of fishery resources.
- The depletion of fishery resources intensifies conflicts and results in low catches/incomes and dissipation of resource rents.
- Dissipated resource rents imply greatly reduced (if not negative) pure profit for individual fishers and entire fisheries; pure profits or rents which when captured could be used to improve management, enhance occupational mobility and fight poverty among municipal fishers.
- Reduced incomes from fishing coupled with few supplemental or alternative income sources induce further increases in fishing intensity, thus locking the situation in a downward spiral of increasing fishing effort.
- The systems and structures for fisheries management that should arrest the above issues are inadequate for these tasks.
- Systems and structures for fisheries management are inadequate because funds to support them are inadequate. The latter reflects the low priority that the government gives to fisheries.

The interconnections among the issues negate a piecemeal approach to fisheries management, whether at the national level or at specific fishing grounds. One might succeed in temporarily arresting a particular subset of issues in Figure 4, but sooner or later the impacts of the other neglected issues will intensify and eventually overwhelm the system again, thus nullifying the short-term gains. The implication is clear: the issues must be tackled simultaneously within an integrated management framework. Fortunately, some examples of integrated fisheries and coastal resources management exist in the Philippines. Lessons from these examples can point the way for the future.

Opportunities for Fisheries Management

Given the many intense issues in the marine fisheries sector, it is easy to miss its potentials, yet opportunities for improved management do exist. In general, tropical fisheries are characterized by many species with fast growth and turnover. This suggests that if pressure on fish stocks is reduced, recovery periods will be shorter than in temperate areas. Thus, if the right investments are made, tangible benefits can be realized within relatively short periods of time.

With regard to coral reefs, Aliño *et al.* (this vol.) hypothesize that local reefs are resilient because of their high diversity, which suggests that the situation could be worse if not for this natural characteristic of Philippine reefs. Aliño *et al.* (this vol.) caution, however,

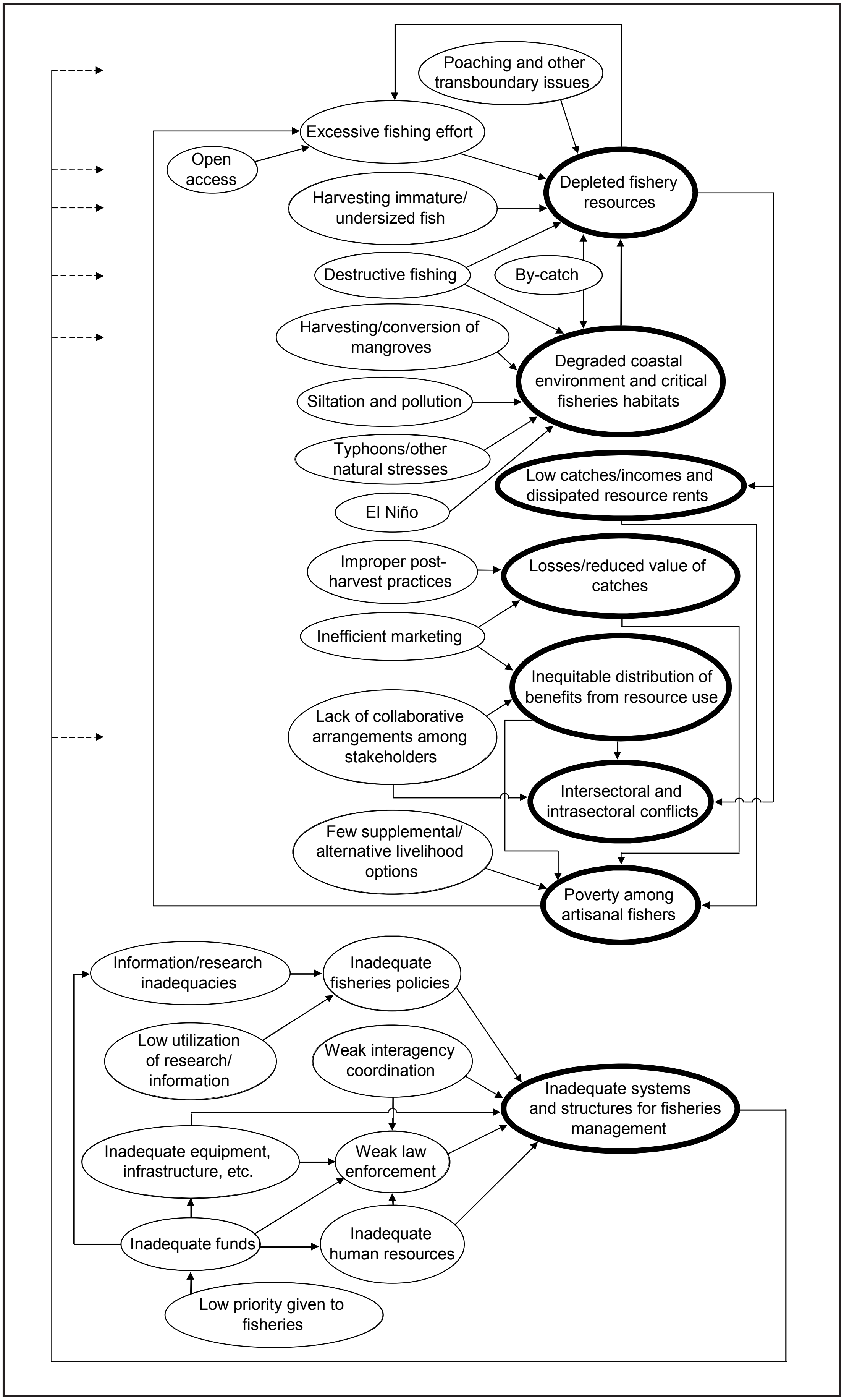


Figure 4. The interconnected issues in Philippine marine fisheries.

that there is probably a time lag before the full impact of accumulated stresses on reefs is manifested. Thus, actions to protect coral reefs are urgent but can provide sizeable rewards.

In recent years, community and stakeholder participation in resource management has been increasing. This has been facilitated in part by recent laws such as the Local Government Code and the Fisheries Code as well as several major donor-assisted CRM projects. The nation has invested in these regulatory frameworks and projects, and with more strategic investments (e.g., full-blown integrated management of pilot areas), the benefits of these regulatory schemes can be demonstrated, at least in pilot areas. The management systems currently being tested in selected areas can pave the way for widespread adoption of decentralized, stakeholder stewardship of local resources.

Lastly, the rent dissipation of at least US$420 million annually can be viewed another way. The size of this economic loss is the same amount that can be potentially generated by the marine fisheries sector if allowed to recover over a long period and managed sustainably. This long-term prospect suggests that it is possible to have a marine fisheries sector that will provide decent incomes for its fishers and have enough revenues left to finance a functioning management system.

Fisheries Management Objectives

To resolve the issues and take advantage of the opportunities, the Philippine marine fisheries sector must have a clear vision of where it needs to go. One way to articulate this vision is to define strategic objectives for the sector (Figure 5). An earlier version of this objectives tree was one of the outputs of a National Workshop in September 2000 sponsored by the Philippine subproject under the Asian Development Bank Regional Technical Assistance 5766 - Sustainable Management of Coastal Fish Stocks in Asia Project. That objectives tree was used as basis for Figure 5, which was presented and deliberated upon by participants during the Third Workshop conducted as part of the profiling process (see Section I).

The overall goal is to achieve sustainable utilization of marine fisheries. This goal is to be pursued within the framework of integrated coastal and marine resources management (see Hermes, this vol. and Pido, this vol.). The latter is suggested in the objectives tree by the higher goal of "optimal utilization of coastal and marine resources" enclosed in dashed lines.

The goal of sustainable utilization of marine resources is elaborated by environmental, economic, social and institutional objectives. The environmental objectives distinguish between fishery resources and the environment that sustains them. This distinction may seem unnecessary, since fishery resources are part of the environment, and therefore a single objective to protect the environment will cover fishery resources as well. However, the intent is to emphasize the need to broaden the scope of traditional fisheries management, which tends to regard such things as water quality and habitat management as outside its scope.

The single, all-encompassing economic objective is to maximize economic benefits from utilization of fishery resources. This objective is a less technical version of the standard economic objectives to "maximize resource rents" or "maximize economic yield". The social and institutional objectives are self-evident.

On the right side of Figure 5 is a set of objectives that will address all eight characteristic issues described earlier. This set checks whether the set of strategic objectives is complete.

Six Critical Actions to Reverse the Decline of Philippine Marine Fisheries

Earlier, we argued that the interconnections among the issues, which are depicted in Figure 4, necessitate an integrated approach to fisheries management. In Figure 6, we have reconstructed Figure 4 by reversing the issues, thus, revealing the various steps necessary to initiate the recovery of Philippine marine fisheries. The various steps are grouped into six critical actions that together comprise an integrated fisheries management approach. Each of the critical actions is briefly described, as follows.

Reduction and rationalization of fishing effort. As most of the country's fisheries are either fully exploited or overfished, reduction of fishing effort is something that should have been done a long time ago. It is important to realize that the amount of effort reduction required will be huge in most cases. For small pelagics as a whole, effort should be decreased by an estimated 50-65% (Zaragoza, this vol.). This implies that in most fishing grounds, reduction of effort to sustainable levels will be a long-term goal. The full range of measures should be tested and employed if applicable, including area and seasonal closures, gear restrictions and licensing. In particular, the development of a fully functioning licensing system for commercial and municipal sectors should be given priority because it can be used to facilitate the implementation of gear restrictions and area and seasonal closures (Trudeau, this vol.).

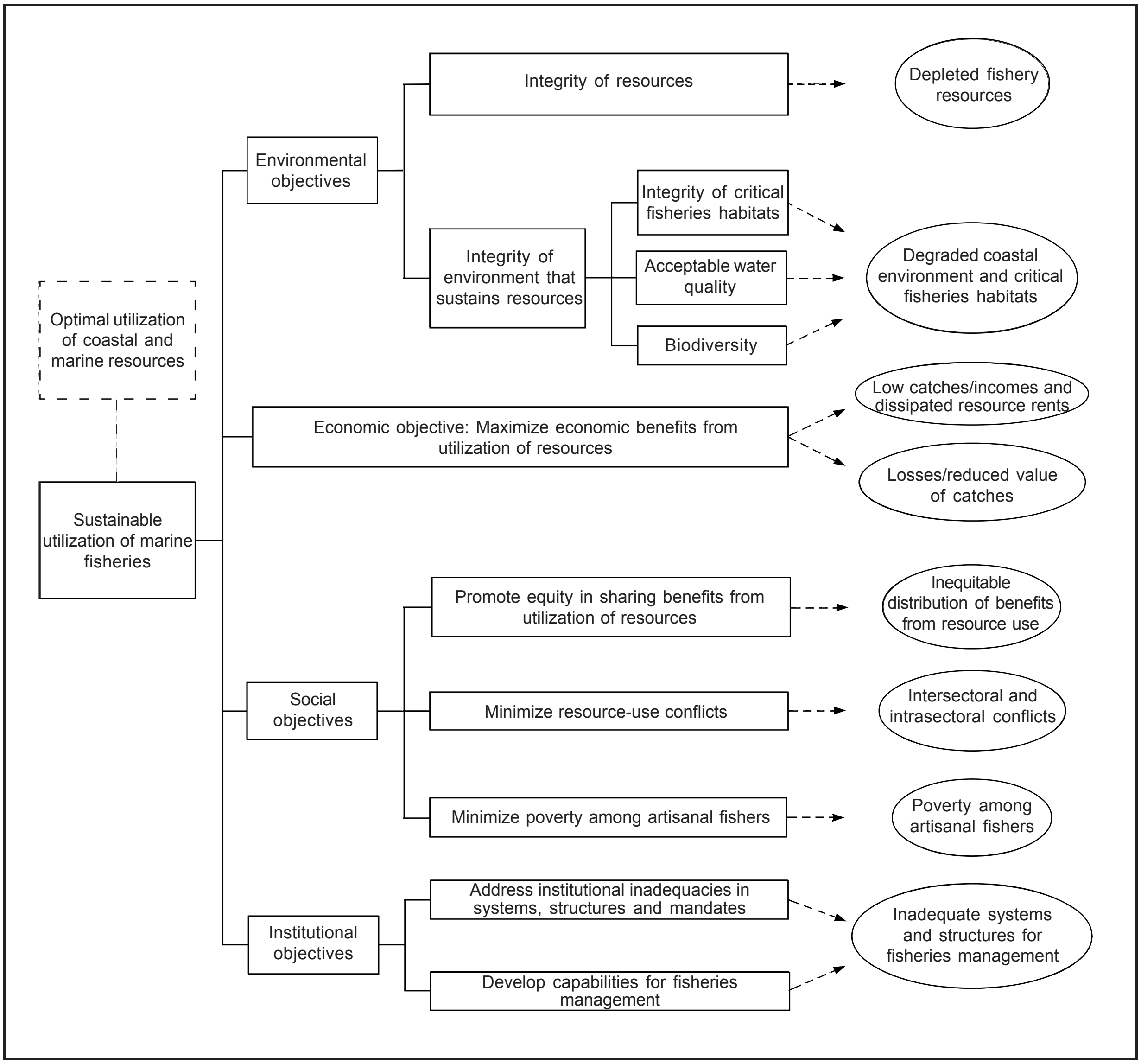


Figure 5. Strategic management objectives to address the characteristic issues.

Protection, rehabilitation and enhancement of coastal habitats. In the Philippines, the rehabilitation of mangroves and the establishment of marine protected areas (MPAs) are perhaps the most widely implemented interventions among the suite of CRM measures. Successful examples of community-based stewardship of mangroves should be replicated widely, with priority given to saving existing mangroves (White and de Leon, this vol.). MPAs are increasing in popularity, yet only about 16-38% of them are strictly enforced and many are too small (Aliño *et al*., this vol.). More functioning MPAs are needed, particularly to protect spawning areas and other fish aggregation sites. The MPA rating system described by White *et al.* (this vol.) can assist to improve the quality and effectiveness of MPA management nationwide. Also, integrated planning for and among MPAs is essential to provide larger overall benefits to habitat protection and thus fisheries management.

Improved utilization of harvests. Losses due to spoilage can be reduced through provision of post-harvest facilities and training of fishers in proper post-harvest handling. Training should focus on women since they are more involved than men in post-harvest activities (Siason, this vol.). Improvements in gear technology (and their spatial and temporal disposition) are in order to reduce by-catch and discards.

Enhanced local stewardship and management of resources. At the moment, the concept of empowering communities to manage local resources is well-known but not as widely adopted as it should be. Local stewardship and management of resources must be inclusive and based on the LGU through comprehensive CRM planning and implementation. It

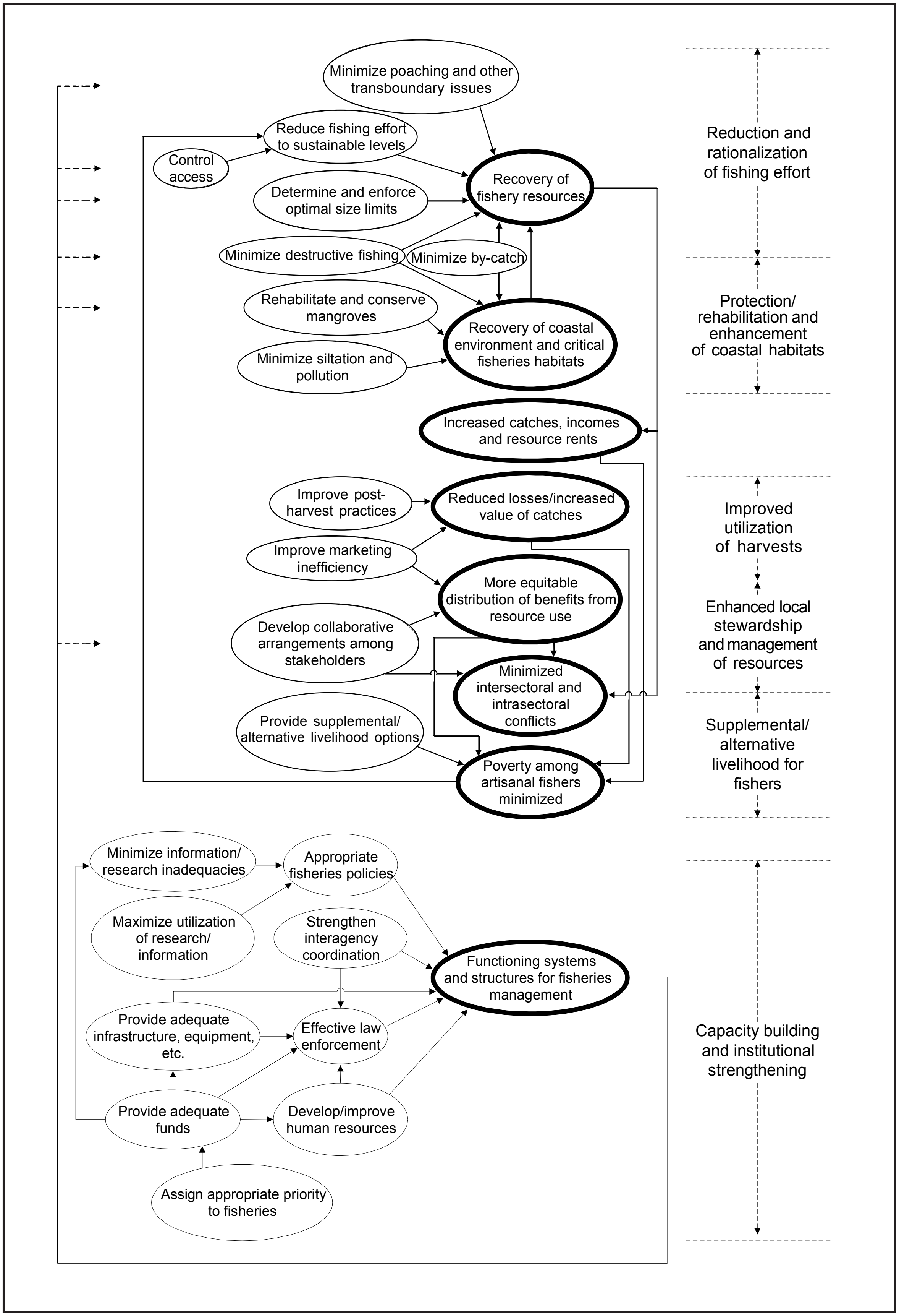


Figure 6. Six critical actions (listed on the right) to reverse the decline of Philippine marine fisheries. The "reversed issues" on the left (compare with Figure 4) suggest the components that should comprise these critical actions while the "reversed characteristic issues" in darkened outlines indicate the end results of these actions.

should not be equated solely with organizing small fishers to better repel commercial fishing boats that intrude into municipal waters. Efforts should be made to involve all stakeholders in constructive planning and actions.

Supplemental/alternative livelihood for fishers. The need to provide supplemental and alternative livelihood for fishers cannot be overemphasized, particularly in the case of small fishers who are mired in poverty and are fishing to survive. Asking the latter to give up or reduce their fishing is equivalent to inviting them to starve. A good argument can be made for facilitating such livelihoods as a first or parallel intervention in site or fisheries management.

Here, fisheries researchers and resource managers need to become creative and to reach out to and network with development experts, particularly those in rural medium and small-scale industries and in provision of alternative (agricultural) credit facilities. While ecotourism in MPAs is an attractive concept, not all coastal areas possess tourism potential. Fisheries planners must be open to linking their efforts with ongoing integrated area development or regional development planning in their areas.

Capacity building and institutional strengthening. Capacity building in resource assessment, management planning, implementation and enforcement is needed at national and local levels. Training in skills for integrated coastal resources planning and management is essential to build up a system that addresses the complexity of issues.

The six critical actions to reverse the decline of Philippine marine fisheries need to be implemented within a framework that reflects an ongoing process for fisheries and coastal resources management. A system that is beginning to work at the local government level for jurisdictions within 15 km reflects a planning and implementation framework that encompasses the needs of fisheries management. The basic steps and processes that accommodate the critical actions elaborated above include:

- resources assessment in a manner that provides useful information for management planning and that informs and educates the stakeholders of concern;
- coastal resources and fisheries management planning at a scale that facilitates coordination, implementation and feedback into the management planning cycle within and among LGUs;
- institutional capacity building at various levels in government to facilitate the management planning process and to catalyze implementation using tested techniques and successful field projects;
- facilitating coordination and participation among and by all concerned stakeholders in the government, nongovernment and private sectors;
- raising awareness of the management rules and the process of implementation through various education and media programs;
- enforcement of rules set by management through multisector teams; and
- research, monitoring and evaluation that continue to inform management planning and implementation.

Reviewing Our Thought Process

This paper began by considering the issues, the fisheries management objectives to address the issues and the critical actions to achieve the management objectives. Figure 7 reviews our thought process and indicates that we followed a simple and logical planning framework. Thus, we first took stock of "where we are now" by analyzing the issues and opportunities in fisheries. This provided a basis upon which we could reflect on "where we want to go," which was articulated in terms of fisheries management objectives. Finally, having defined where we wanted to go, we outlined six critical actions to get there.

Similar to Figure 7, the Consensus Statement in Annex 1 summarizes the main points of this paper. It is intended for busy policymakers who do not have the time to go through this book. But such policymakers are the ones who are most in need of realizing the situation of Philippine marine fisheries and the critical actions to arrest its decline. The third and final Multisectoral Workshop held in connection with this book was devoted to finalizing the fisheries management framework in Figure 7 and the Consensus Statement in Annex 1.

Concluding Remarks

Decades of neglect have brought Philippine marine fisheries into its present state of being "in turbulent seas". Undoing decades of damage is definitely a long-term undertaking, but it can be hastened and made more effective by actions that are executed strategically within an integrated management framework. We need to demonstrate that the issues in fisheries can be reversed. We can start by implementing the six critical actions in demonstration sites. At the national level, coastal resource and fisheries policies should be aligned to support area-specific efforts and to address the issues discussed, particularly those related to institutional weaknesses and constraints.

The main aim of this profile is to provide a synoptic

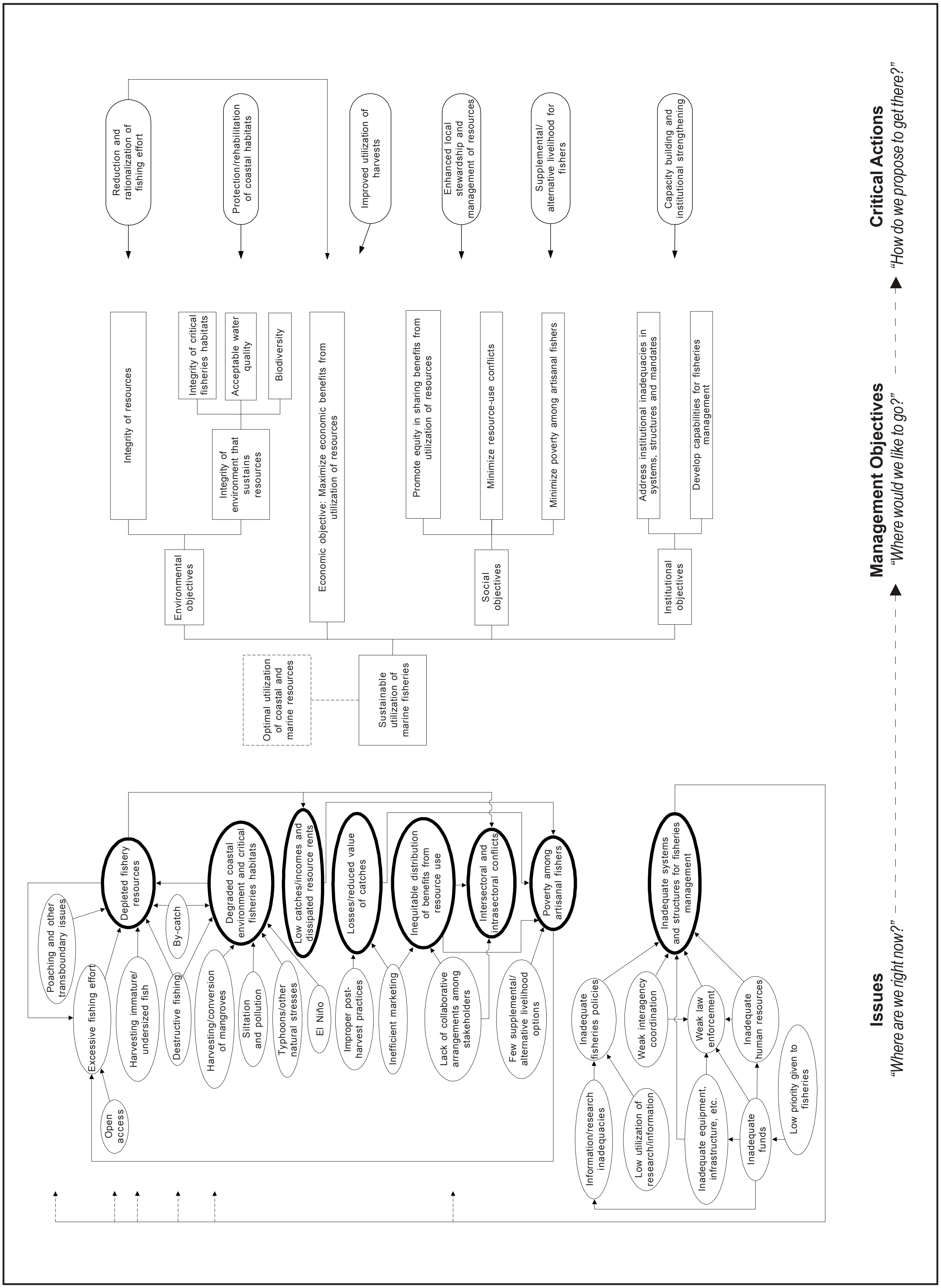


Figure 7. A fisheries management framework illustrating the essential conceptual steps that lead to the identification of critical actions.

picture of the status, problems and directions for improved management of Philippine marine fisheries. To reiterate, its specific objectives are to:

- provide a concise yet comprehensive view of the status of the country's marine fisheries— resources, environment and resource users, as well as policies and currently available tools for resource management;
- identify appropriate management directions or objectives for Philippine marine fisheries given its current status and evident future trends; and
- explore viable interventions to achieve our fisheries management objectives and sustain the benefits derived by the country from its marine fisheries.

Through the collective efforts of the coastal and fisheries researchers and managers who came together to produce this profile, it has indeed achieved the above objectives. The many who were involved should take pride in this success. Yet as valuable as this achievement is, it will remain hollow if the recommendations of this profile fall on deaf ears and no concrete actions are implemented. The time for reflections, studies and debates is over. Let us unite behind the simple truths outlined in this contribution concerning the depleted status of Philippine fisheries, continue local efforts to improve conditions in particular fishing grounds in whatever way possible at the regional and national levels, and become active advocates for sustainable marine fisheries.

Reference

Gomez, E.D., P.M. Aliño, H.T. Yap and W.Y. Licuanan. 1994. A review of the status of Philippine reefs. Mar. Pollut. Bull. 29(1-3): 62-68.

Annex 1. The 2003 Call to Action by the Philippine Fisheries and Marine Science Community for Improved Management of the Country's Fisheries and Coastal Resources

Fisheries in the coastal and marine waters of the country provide substantial benefits to the Filipino nation. Among others, these fisheries provide food and essential nutrients that are a daily part of the Filipino diet; substantive employment and sustenance particularly in rural coastal areas; and valuable foreign exchange for the country's developing economy. In 2001, these fisheries produced 1.8 million t of fish and other fishery products valued at P67.4 billion. Exports of fish and fishery products was 289.4 thousand t valued at P10.7 billion. Per capita fish consumption during the same year was 26.4 kg per year, which is among the highest in the world. In 1997, a total of 732.4 thousand fishers were employed in these fisheries on full and part-time bases. More than these benefits, fisheries in coastal and marine waters are particularly important to food security and social stability in the country's rural coastal areas.

Apart from fisheries, the country's coastal resources (including mangroves, seagrass beds and coral reefs) provide considerable benefits and services to the nation. Mangroves and seagrass beds stabilize coastlines, serve as nursery habitats for various organisms, export nutrients to adjacent habitats and perform various other ecological functions. The country's coral reefs, which total area is equivalent to about 10% of the total land area, support highly diverse communities of marine organisms and provide coastal protection and opportunities for tourism. The annual contribution of coral reefs and mangroves to the national economy in terms of harvestable resources, tourism, coastal protection and other uses are conservatively estimated at P54 billion and P3.4 billion, respectively.

Sustaining the numerous benefits derived by the Filipino nation from the country's fisheries and coastal resources is seriously threatened by a host of problems. Having reviewed the status of these resources based on the best available scientific evidence, we have arrived at the following conclusion:

- The marine fishery resources of the country are severely depleted. In the case of demersals, for example, biomass levels are today only 10-30% of the levels in the late 1940s. For small pelagics, by the 1980s the average catch rate was only one-sixth of the rate in the 1950s. In reef fisheries, the present catch rates are among the lowest in the world.
- Coastal habitats that are critical for supporting fisheries are severely degraded. Less than one-third of mangrove areas remain of the original 450,000 ha in 1918, and 95% of the remaining mangroves are secondary growth of much lower quality. An estimated half of seagrass beds have been lost or severely degraded during the past 50 years. Over 70% of the coral reefs in the country are in a poor state, while less than 5% are in excellent condition.
- On the average, about 25-30% of total catch is lost due to improper postharvest practices. Inefficient marketing results in further economic losses.
- Commercial and municipal fishers remain locked in intense competition despite laws designed to

separate their fishing grounds. Conflicts between and within these sectors are severe and continue to escalate.

- Poverty is a ubiquitous feature of coastal communities. As high as 80% of small fishers live below the poverty threshold.
- At both national and local levels, our systems for fisheries management are characterized by: (i) inadequate policies for fisheries and coastal resource management, (ii) weak interagency coordination and weak law enforcement; and (iii) inadequate human resources and capacity, infrastructure and equipment.

Sustaining the host of benefits obtained from the country's fisheries and coastal resources requires urgent and concerted action by responsible authorities and the wider community of stakeholders at the national, regional and local levels. Action is required in the following areas:

- Reduction and rationalization of fishing capacity, including
  - replacement of open access systems with rights-based licensing schemes;
  - removal of subsidies (both direct and indirect);
  - regulation and rationalization of use and deployment of fishing gears to reduce bycatch and environmental impacts of fishing;
  - effective banning of illegal and destructive fishing gears;
  - responsible fisheries monitoring and enforcement schemes;
  - fishing zonation schemes to reduce municipal and commercial conflicts;
  - exploring the use of fishery product certification schemes;
- Rehabilitation of coastal habitats and environmental quality, including
  - wider use of systems of aquatic protected areas;
  - resources enhancement and rehabilitation programs;
  - reduction of coastal environmental impacts from land and water-based activities;
- Improved utilization of harvests, including
  - improvement of postharvest methods/practices;
  - improvement of marketing systems;
- Enhanced local stewardship and management of resources, particularly
  - increased participation by fishers in all aspects of fisheries management;
- Alternative and supplemental livelihood and investment opportunities, particularly
  - provision of alternatives to capture fisheries in tandem with closed seasons, gear restrictions and other measures to ease pressure on fishery resources;
- Capacity-building and institutional strengthening, including upgrading of the policy, regulatory and institutional systems for fisheries and coastal resources management.

Programs of action in these areas should be built into integrated fisheries and coastal resources management plans that should be urgently formulated at the local, regional and national levels. These plans should be put into action by responsible authorities jointly with the wider community of stakeholders using fisheries and coastal resources.

We appeal to responsible authorities and agencies to take stock of the problems and urgently put in place the necessary programs of action for the benefit of current and future generations of Filipinos. Recognizing that progress in sustaining the benefits from our coastal resources will take time and sustained collaborative efforts, we appeal to the wider community of stakeholders for unity in meeting the challenges ahead.

Adopted at the Workshop on Management of Philippine Fisheries and Coastal Resources 15 May 2003, Quezon City, Philippines

Appendix and Index

Appendix I. Directory of Contact Persons and Participants during the Profiling Process

Acosta, Rene B.
Local and National Government Advisor
United States Agency for International Development
8/F PNB Financial Centre, Roxas Blvd., Pasay City
Phone/fax no. (02) 552-9829/551-9081 loc. 5412
Mobile no. 0917-8471286
E-mail: racosta@usaid.gov

Adan, William R., Ph. D.
Professor
Development Communication and Management
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Phone/fax no. (08822) 720-553/720-552
Mobile no. 0917-7064565
E-mail: willyadan@yahoo.com

Aguilar, Glenn, Ph. D.
Associate Professor/Vice Chancellor for Planning and Development
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas, Miagao, Iloilo 5023
Phone/fax no. (+6333) 315-8312/315-8381

Alava, Moonyeen
Consultant
FishBase Project
WorldFish Center-Philippine Office
Khush Hall, IRRI College, Los Baños, Laguna 4031
Phone/fax no. (049) 536-0168/536-0202

Alesna, Edwyn
Senior Fishing Regulation Officer
Bureau of Fisheries and Aquatic Resources
860 Arcadia Bldg., Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 372-5046/373-7453

Aliño, Porfirio, Ph. D.
Marine Ecologist
Philippine Environmental Governance Project
3/F M&L Bldg., 29 Road 1, Project 6, Quezon City
Phone/fax no. (02) 927-9190/927-8836
Mobile no. 0917-8387042
E-mail: pmaliño@upmsi.ph

Almocera, Mario
Professor
University of the Philippines – Visayas
Cebu College, Gorordo Ave., Lahug, Cebu City
Phone/fax no. (032) 233-8396
Mobile no. 0917-3206194
E-mail: aalmocera@yahoo.com

Arcamo, Sandra Victoria R.
Chief
Fisheries Resource Management Division
Bureau of Fisheries and Aquatic Resources
860 Arcadia Bldg., Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 372-5044/372-5049
E-mail: frmd@bfar.stream.ph; sarcamo@mail.super.net.ph

Armada, Nygiel B.
Associate Professor
University of the Philippines - Visayas, Miagao, Iloilo
Phone/fax no. (033) 315-8312/315-8381
Mobile no. 0917-6090834
E-mail: nbarmada@siisnet.com

Atrigenio, Michael P.
Country Grant Manager
Critical Ecosystem Partnership Fund
Conservation International
5 South Lawin, PhilAm Homes, Quezon City
Mobile no. 0918-9119117
E-mail: m_atrigenio@conservation.com.ph

Babaran, Ricardo
Professor
Institute of Marine Fisheries and Oceanology
College of Fisheries and Ocean Sciences
University of the Philippines in the Visayas, Miagao, Iloilo 5023
Phone/fax no. (+6333) 315-8312/315-8381
E-mail: rpbabaran@yahoo.com

Ballesteros, James
Project Assistant
World Wide Fund for Nature – Philippines
LBI Building, 57 Kalayaan Ave., Brgy. Pinyahan, Quezon City
Phone/fax no. (02) 436-7311/433-0911
E-mail: jballesteros@wwf-phil.org.ph

Barangan, Florendo B.
Director
Coastal and Marine Management Office
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Phone/fax no. (02) 926-1004/926-1004
E-mail: cmmo26@yahoo.com

Barut, Noel C.
Chief
Marine Fisheries Research Division
National Fisheries Research and Development Institute
Bureau of Fisheries and Aquatic Resources
Kayumanggi Press Bldg., 940 Quezon Avenue, Quezon City
Phone/fax no. (02) 373-6336/372-5063
Mobile no. 0917-8385701
E-mail: noel_barut@hotmail.com

Baylon, Maria L.
Program Manager
Environmental Science for Social Change
1/F Manila Observatory Bldg., Ateneo University Campus
Loyola Heights, Quezon City
Phone/fax no. (02) 426-0554/426-5958
E-mail: mlbaylon@edsamail.com.ph

Bruce, Lina Manalo
Conservation International
5 South Lawin, PhilAm Homes, Quezon City
Mobile no. 0918-9119117
E-mail: lmbruce@i-manila.com.ph

Cabangon, Romelo P.
Project Development Officer IV
Coastal and Marine Management Office
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Phone/fax no.(02) 929-6626 loc. 2186/925-1182
Mobile no. 0919-7864736
E-mail: forester_diver@yahoo.com

Campos, Maribec
Consultant Resource Economist
SEAMEO Regional Center for Graduate Study and Research in Agriculture
SEARCA, College, Los Baños, 4031 Laguna
Phone/fax no. (049) 536-2290

Campos, Wilfredo L.
Assistant Professor
Division of Biological Science, College of Arts and Sciences
University of the Philippines - Visayas, Miagao, Iloilo
Phone/fax no. (033) 315-9271
E-mail: oceanbio2002@yahoo.com

Carreon, Marciano III F.
Deputy Chief of Party
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-5276508
E-mail: marcoc@mozcom.com

Castillo, Gem B.
Resource Valuation/MIS Specialist
Philippine Environmental Governance Project
3/F M&L Bldg., 29 Road 1, Project 6, Quezon City
Phone/fax no. (02) 927-9190/927-8836

Corrales, Joezen D.
Aquacultural Technologist
Bureau of Fisheries and Aquatic Resources - VII
Arellano Blvd., Cebu City
Phone/fax no. (032) 256-1666/256-2773
Mobile no. 0917-4688205
E-mail: joezen@hotmail.com

Cruz-Trinidad, Annabelle
Task Leader, Policy Component
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-5299041
E-mail: abbie@trinidad.com.ph

Dela Cruz, Emmanuel V.
Chair
MAMAMAYAN – PAKISAMA
59 Salvador St., Loyola Heights, Quezon City
Phone/fax no. (02) 436-1689/436-3477

Dela Cruz, Marlyn V.
National Council, MAMAMAYAN
56 Salvador St., Loyola Heights Subd., Quezon City

Dichoso, Maximo O.
Deputy Executive Director
Department of Environment and Natural Resources
Visayas Avenue, Diliman, Quezon City
Phone/fax no. (02) 926-1004/926-1004
Mobile no. 0919-8944782
E-mail: cmmo26@yahoo.com

Dickson, Jonathan
Chief
Technological Division
Bureau of Fisheries and Aquatic Resources
860 Arcadia Bldg., Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 372-5046/373-7453

Dugan, Chito E.
R&D Officer
SIKAT, Inc., Unit 338, Eagle Court Condominium
26 Matalino St., Brgy. Central, Quezon City
Phone/fax no. (02) 922-5911/433-9106

Eisma, Rose-Liza V., Atty.
Executive Director
Coastal Conservation and Education Foundation, Inc.
PDI Condominium, Banilad, Cebu City
Phone/fax no. (+6332) 233-6909/233-6891
E-mail: ceef@mozcom.com

Eleserio, Fileonor O.
Chief
Fishing Gear and Method Section
Capture Fisheries Division
Bureau of Fisheries and Aquatic Resources
860 Arcadia Bldg., Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 372-5044/372-5049

Encabo, Sheila
Supervising Economics and Development Specialist
National Economic and Development Authority
NEDA Building, Jose Ma. Escriva Drive, Ortigas Center, Pasig City
Phone/fax no. (02) 631-2187

Evacitas, Florence C.
University Research Associate
University of the Philippines – Visayas
Cebu College, Gorordo Ave., Lahug, Cebu City
Phone/fax no. (032) 233-8396
Mobile no. 0916-5207487
E-mail: fcevacitas@yahoo.com

Fabres, Boris A.
Officer-in-Charge
WorldFish Center – Philippine Office
Khush Hall, IRRI College, Los Baños, Laguna 4031
Phone/fax no. (049) 536-0168/536-0202
E-mail: bfabres@cgiar.org

Feibel, Charles, Ph. D.
Chief of Party
Growth with Equity in Mindanao Program
2/F, 1 Ladislawa Bldg., Ladislawa Ave.
Buhangin Rd., 8000 Davao City
Phone/fax no. (+6382) 225-1569 to 71; 225-1470/225-1479

Floren, Jessie O.
GIS Specialist
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0919-6706463
E-mail: crmgis@mozcom.com

Flores, Jimely
Fishery Biologist
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-4394945
E-mail: jflores@oneocean.org

Garces, Len R.
Fisheries/Marine Biologist
Coastal and Marine Resources Research Program
WorldFish Center - Malaysia
Jalan Batu Maung, Batu Maung
11960 Bayan Lepas, Penang, Malaysia
Phone/fax no. (+604) 626-1606/626-5530
E-mail: l.garces@cgiar.org

Garcia, Jeneen R.
Science Researcher/Writer
Environmental Legal Assistance Center
354-P Betty Lu Compound, Queens Road, Cebu City
Phone/fax no. (0632) 2533833/2561495
Mobile no. 0917-5488879
E-mail: jeneen@elac.org

Gonzales, Benjamin, Ph. D.
Assistant Professor
State Polytechnic College of Palawan
Sta. Monica, Puerto Princesa City, Palawan 5300
Phone/fax no. (048) 434-3908/433-4480/433-4367

Green, Stuart J.
Task Leader, Fisheries Management Component
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0918-9036008
E-mail: bosicadd@mozcom.com

Guerrero III, Rafael D., Ph. D.
Executive Director
Philippine Council for Aquatic and Marine Research
and Development
Los Baños, Laguna
Phone/fax no. (049) 536-5579/536-1582
E-mail: pcamrd@laguna.net

Guidote, Marlito
Task Leader, Law Enforcement and Delineation Component
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0919-2929716
E-mail: mguidote@oneocean.org

Hermes, Jasmin
Fisheries Consultant
6 Sorsogon St., Levitown Executive, 1700 Parañaque City
Phone/fax no. (+632) 824-2027
E-mail: hermes@mozcom.com

Hermes, Rudolf, Ph. D.
GTZ Project Advisor
Visayan Sea Coastal Resources and Fisheries
Management Project
Muelle Loney St., 5000 Iloilo City
Phone/fax no. (+6333) 336-2708/336-2708
Mobile no. 0917-7411225
E-mail: vissea@skyinet.net

Hilomen, Vincent V., Ph. D.
Assistant Professor
Institute of Biological Sciences
University of the Philippines - Los Baños, College, Laguna
Phone/fax no. (049) 536-2843/536-2517
Mobile no. 0919-2097438
E-mail: vvh@agri.searca.org; vvhilomen@yahoo.com

Hodgson, Gregor, Ph.D.
Reefcheck Director
University of California at Los Angeles
California, USA
E-mail: gregorh@ucla.edu

Ingles, Jose A., Ph. D.
Director
WWF-SSME Fisheries Management Program
World Wide Fund for Nature – Philippines
LBI Building, 57 Kalayaan Ave., Brgy. Pinyahan, Quezon City
Phone/fax no. (02) 436-7311/433-0911
E-mail: jingles@wwf-phil.org.ph

Israel, Danilo, Ph. D.
Senior Research Fellow
Philippine Institute for Development Studies
NEDA sa Makati Bldg. 106 Amorsolo St.
Legazpi Village, Makati City 1229
E-mail: disrael@mail.pids.gov.ph

Jatulan, William
Task Leader, Institutional Development Component
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-3217592
E-mail: wjatulan@mozcom.com

Jensen, Catalina C.
Management and Monitoring Specialist
Growth with Equity in Mindanao Program
2/F, 1 Ladislawa Bldg., Ladislawa Ave.
Buhangin Rd., 8000 Davao City
Phone/fax no. (+6382) 225-1569/225-1479
E-mail: linajensen@mindanao.org

Juinio-Meñez, Marie Antonette, Ph. D.
CRM Specialist
Philippine Environmental Governance Project
3/F M&L Bldg., 29 Road 1, Project 6, Quezon City
Phone/fax no. (02) 927-9190/927-8836
Mobile no. 0917-2742443
E-mail: amenez@dai.com

Lagura, Nelia C., Atty.
Legal Staff
Environmental Legal Assistance Center, Inc.
354-P Betty Lu Compound, Queens Road, Cebu City
Phone/fax no. (032) 253-3833/256-1495; Mobile no. 0917-7616101
E-mail: nelia@elac.org.ph

Leask, Karen D.
Marine Biologist
Environmental Science for Social Change
1/F Manila Observatory Bldg., Ateneo University Campus
Loyola Heights, Quezon City
Phone/fax no. (02) 426-5921/426-5958
Mobile no. 0918-5509879
E-mail: leaskkd@hotmail.com

Licuanan, Wilfredo Y., Ph. D.
Director
Shields Marine Station, De la Salle University
2001 Taft Ave., Manila
Phone/fax no. (02) 524-0451
E-mail: coswyl@mail.dlsu.edu.ph

Luna, Cesar Z.
Fisheries Specialist
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0916-4112542
E-mail: ces_luna@oneocean.org

Mamauag, Samuel S.
Grouper Fishery Biologist
International Marinelife Alliance
83 West Capitol, Kapitolyo, Pasig City
Phone/fax no. (02) 635-3530/638-7119; Mobile no. 0917-7496905
E-mail: smamauag@yahoo.com

Muñoz, Jessica C.
Project Director
Fisheries Resource Management Project
2/F Estuar Bldg., 880 Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 410-9990/372-5008
E-mail: jmunoz@frmp.org

Ochavillo, Domingo, Ph. D.
Marine Biologist
Reefcheck
Marine Science Institute
University of the Philippines, Diliman, Quezon City
Phone/fax no. (02) 920-5301 ext. 7426/924-7678
Mobile no. 0917-2420285
E-mail: ochavillo@yahoo.com

Pacunio, Virginia
Executive Director
Touch Foundation
M.H. del Pilar St., Cagayan de Oro City
Phone/fax no. (+6382) 724-663
E-mail: touch@mozcom.com

Pagdilao, Cesario R.
Deputy Executive Director
Philippine Council for Aquatic and Marine Research and Development
Los Baños, Laguna
Phone/fax no. (049) 536-5578/536-1582
Mobile no. 0917-9775644
E-mail: dedo@laguna.net

Panorel, Apronianو
Executive Director
Pipuli Foundation
Dy Apartments, Bernard Subd., Postal Road, Ozamis City
Phone/fax no. (+6388) 521-1992, 521-1928
E-mail: pipuli@ozamis.com

Pido, Michael, Ph. D.
Professor
Graduate School, Palawan State University
Manalo Campus, Mendoza St., Puerto Princesa City
Phone/fax no. (048) 433-5303
Mobile no. 0919-4308206
E-mail: mdpido@yahoo.com

Rayos, Joseph C.
Aquaculturist
National Fisheries Research and Development Institute
940 Kayumanggi Bldg., Quezon Avenue, Quezon City
Phone/fax no. (02) 372-5063
E-mail: totep2000@yahoo.com

Reid, Heather L.
Fisheries Licensing Intern
Fisheries Resource Management Project
Puerto Princesa City, Palawan
Phone/fax no. (048) 434-4924
E-mail: heatherlymreid@hotmail.com

Rodriguez, Marita P.
Project Development Officer
Center for Empowerment's Resource Development
102-E R.L. Mendoza Bldg., Kamuning, Quezon City
Phone/fax no. (02) 9251642/9240944
E-mail: cerd@skyinet.net

Sadorra, Marie Sol
Consultant, Information, Education and Communication
Tetra Tech Environmental Management, Inc.
17/F OMM-Citra Condominium, San Miguel Ave., Ortigas Center, Pasig City
Phone/fax no. (+632) 634-1621/365-8669
Mobile no. 0918-6913234
E-mail: mariesol@compass.com.ph; mariesol@oneocean.org

San Diego-McGlone, Maria Lourdes
Professor
Marine Science Institute
University of the Philippines, Diliman, Quezon City
Phone/fax no. (02) 920-5301 ext. 7426/924-7678

Santos, Ronet S.
Regional Program Coordinator – SPARK
Voluntary Service Overseas
20 South Lawin Ave., PhilAm Homes, Quezon City
Phone/fax no. (02) 927-3304/426-2761
E-mail: ronet.santos@vsoint.org

Sayson, Protacia R.
Chief
Fisheries Resource Management Division
Bureau of Fisheries and Aquatic Resources - VII
Arellano Blvd., Cebu City
Phone/fax no. (032) 256-1666/254-8492; Mobile no. 0916-5367400
E-mail: bfar@nexmil.com

Serrano, Rommel R.
Research Associate
SEAMEO Regional Center for Graduate Study and Research in Agriculture
SEARCA, College, Los Baños, 4031 Laguna
Phone/fax no. (049) 536-2290
E-mail: rrs@agri.searca.org

Silvestre, Geronimo T.
Fisheries Specialist
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-5362377
E-mail: gerry.silvestre@oneocean.org

Smith, Rebecca P.
Task Leader, Information, Education and Communication Component
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032) 232-1821/232-1825
Mobile no. 0917-5466929
E-mail: bpsmith@mozcom.com

Swerdloff, Stanley N.
Philippine Advisor
Growth with Equity in Mindanao Program
2/F, 1 Ladislawa Bldg., Ladislawa Ave.
Buhangin Rd., 8000 Davao City
Phone/fax no. (+6382) 225-1569/225-1479
Mobile no. 0917-7141295
E-mail: stans@mozcom.com

Tan, Marfeino
President
South Cotabato Purse Seiners Association
General Santos City
Phone/fax no. (+6383) 380-7255/380-7253

Torres, Francisco Jr.
Aquaculturist
National Fisheries Research and Development Institute
Bureau of Fisheries and Aquatic Resources
Kayumanggi Press Bldg., 940 Quezon Ave., Quezon City
Phone/fax no. (+632) 373-7451
Mobile no. 0919-3406855
E-mail: fsbtorres@hotmail.com

Townsend, Ralph, Ph. D.
Professor
University of Maine
Orono, Maine, USA
Phone/fax no. (207) 581-1110
E-mail: Ralph.Townsend@umit.maine.edu

Trudeau, Hugh
Licensing Specialist/Fisheries Management Consultant
Fisheries Resource Management Project
Puerto Princesa City, Palawan
Phone/fax no. (048) 434-4924/26
Mobile no. 0917-9966359
E-mail: htrudeau@mozcom.com

Tumanda, Marcelino I., Ph. D.
Chancellor
Mindanao State University at Naawan
9023 Naawan, Misamis Oriental
Phone/fax no. (08822) 720-553/720-552
Mobile no. 0917-7065565
E-mail: m_tumanda@yahoo.com

Uychiaoco, Andre Jon, Ph. D.
Project Manager
Marine Environment and Resources Foundation
Marine Science Institute
University of the Philippines, Diliman, Quezon City
Phone/fax no. (02) 920-5301 ext. 7426/924-7678
Mobile no. 0916-3815673
E-mail: andreu@upmsi.ph

Villanoy, Cesar
Associate Professor
Marine Science Institute
University of the Philippines, Diliman, Quezon City
Phone/fax no. (02) 920-5301 ext. 7426/924-7678

Vitug, Annie, Atty.
Division Chief
Licensing and Quarantine Division
Bureau of Fisheries and Aquatic Resources
860 Arcadia Bldg., Quezon Ave., 1103 Quezon City
Phone/fax no. (+632) 372-5044/372-5049

White, Alan T.
Chief of Party
Coastal Resource Management Project
5/F CIFC Towers, J. Luna cor. B.L. Briones Sts.
North Reclamation Area, Cebu City 6000
Phone/fax no. (032)232-1821/232-1825
E-mail: awhite@mozcom.com

Zaragoza, Ester C.
Officer-in-Charge
Marine Resources Division
Philippine Council for Aquatic and Marine Research and Development
Los Baños, Laguna
Phone/fax no. (049) 536-5579/536-1582
E-mail: mrd@laguna.net

Zhou, Weidong
Senior Agriculturist and Natural Resources Officer
Southeast Asian Department, Asian Development Bank
6 ADB Avenue, Mandaluyong City, 0401 Metro Manila
Phone/fax no. (+632) 632-4444/636-2444
E-mail: wzhou@adb.org

These organizations have made this publication possible.

WWF

WorldFish Center

Conservation International Philippines

GEM

UPV-CEIS, Cebu College

Coastal Conservation and Education Foundation, Inc.

VSO

International Marinelife Alliance

Reef Check

EcoGovernance

"The consensus of many of the country's fisheries scientists, managers, and field practitioners from key national and local organizations, as well as fishers, is expressed in this volume: "In Troubled Seas: The Status of Philippine Marine Fisheries." The consensus is that Philippine fisheries resources are being overfished and degraded at an alarming rate and that urgent action is needed to arrest the decline, rebuild the resources to more productive levels and sustain the multitude of benefits derived by the country from its fisheries. There is agreement that the tools available to manage Philippine fisheries largely exist but need to be implemented much more widely and directly supported by effective national and local policies."