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U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2022

US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
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U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2022

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EXECUTIVE SUMMARY

Under the 1994 amendments of the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) were required to generate stock assessment reports (SARs) for all marine mammal stocks in waters within the U.S. Exclusive Economic Zone (EEZ). The first reports for the Atlantic (includes the Gulf of Mexico) were published in July 1995 (Blaylock *et al.* 1995). The MMPA requires NMFS and USFWS to review these reports annually for strategic stocks of marine mammals and at least every three years for stocks determined to be non- strategic. Included in this report as appendices are: a summary of serious injury/mortality estimates of marine mammals in observed U.S. fisheries (Appendix I), a summary of NMFS records of large whale human-caused serious injury and mortality (Appendix II), detailed fisheries information (Appendix III), summary tables of abundance estimates generated over recent years and the surveys from which they are derived (Appendix IV), a summary of observed fisheries bycatch (Appendix V), and estimates of human- caused mortality resulting from the *Deepwater Horizon* oil spill (Appendix VI).

Table 1 contains a summary, by species, of the information included in the stock assessments, and also indicates those that have been revised since the 2021 publication. The 2022 revisions consist primarily of updated abundance estimates and/or revised human-caused mortality and serious injury (M/SI) estimates. A total of 11 Atlantic and Gulf of Mexico stock assessment reports were updated for 2022. This year, the NEFSC revised 1 stock assessment report (the “strategic” North Atlantic right whale report). For 2021, the SEFSC revised 10 reports representing 10 stocks and made a technical update to an additional report. The Rice’s whale has been identified as a unique evolutionary lineage within the Bryde’s whale complex and given official species status. Therefore, the Northern Gulf of Mexico Bryde’s whale SAR has been updated and is now the Northern Gulf of Mexico Rice’s whale SAR. The remaining revisions consist primarily of updated abundance estimates and revised human-caused mortality and serious injury (M/SI) estimates for common bottlenose dolphin stocks. One Western North Atlantic common bottlenose dolphin stock, the Northern South Carolina Estuarine System Stock, changed from “strategic” status to “non-strategic”. A technical update was made to the Northern Gulf of Mexico Bay, Sound, and Estuary Stocks of common bottlenose dolphin SAR that covers 23 Northern Gulf of Mexico stocks. The SAR was not revised, but a technical update was made to move Florida Bay from the Western North Atlantic to the Gulf of Mexico, and Florida Bay is now included within Table 1 and Figure 1, and the number of stocks in the Gulf of Mexico has been updated accordingly. No other changes or updates were made to Northern Gulf of Mexico Bay, Sound, and Estuary Stocks of common bottlenose dolphin SAR

This report was prepared by staff of the Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). NMFS staff presented the reports at the February 2022 meeting of the Atlantic Scientific Review Group (ASRG), and subsequent revisions were based on their contributions and constructive criticism. This is a working document and individual stock assessment reports will be updated as new information becomes available and as changes to marine mammal stocks and fisheries occur. The authors solicit any new information or comments which would improve future stock assessment reports.

INTRODUCTION

Section 117 of the 1994 amendments to the Marine Mammal Protection Act (MMPA) requires that an annual stock assessment report (SAR) for each stock of marine mammals that occurs in waters under USA jurisdiction, be prepared by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), in consultation with regional Scientific Review Groups (SRGs). The SRGs are a broad representation of marine mammal and fishery scientists and members of the commercial fishing industry mandated to review the marine mammal stock assessments and provide advice to the NOAA Assistant Administrator for Fisheries. The reports are then made available on the *Federal Register* for public review and comment before final publication.

The MMPA requires that each SAR contain several items, including: (1) a description of the stock, including its geographic range; (2) a minimum population estimate, a maximum net productivity rate, and a description of current population trend, including a description of the information upon which these are based; (3) an estimate of the annual human-caused mortality and serious injury of the stock, and, for a strategic stock, other factors that may be causing a decline or impeding recovery of the stock, including effects on marine mammal habitat and prey; (4) a description of the commercial fisheries that interact with the stock, including the estimated number of vessels actively participating in the fishery and the level of incidental mortality and serious injury of the stock by each fishery on an annual basis; (5) a statement categorizing the stock as strategic or not, and why; and (6) an estimate of the potential biological removal (PBR) level for the stock, describing the information used in the calculation. The MMPA also requires that SARs be reviewed annually for stocks which are specified as strategic stocks, or for which significant new information is available, and once every three years for non-strategic stocks.

Following enactment of the 1994 amendments, the NMFS and USFWS held a series of workshops to develop guidelines for preparing the SARs. The first set of stock assessments for the Atlantic Coast (including the Gulf of Mexico) were published in July 1995 in the *NOAA Technical Memorandum* series (Blaylock *et al.* 1995). In April 1996, NMFS held a workshop to review proposed additions and revisions to the guidelines for preparing SARs (Wade and Angliss 1997). Guidelines developed at the workshop were followed in preparing the 1996 through 2016 SARs. In 1997 and 2004 SARs were not produced. Guidelines for preparing SARs were revised again in 2016 based largely on recommendations of the 2011 GAMMS III workshop (NMFS 2016). The revised guidelines were followed in preparing the 2017 to 2021 SARs.

In this document, major revisions and updating of the SARs were completed for stocks for which significant new information was available. These are identified by the May 2023 date-stamp at the top right corner at the beginning of each report.

REFERENCES

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TABLE 1. A SUMMARY OF ATLANTIC MARINE MAMMAL STOCK ASSESSMENT REPORTS FOR STOCKS OF MARINE MAMMALS UNDER NMFS AUTHORITY THAT OCCUPY WATERS UNDER USA JURISDICTION.

Total annual mortality serious injury (M/SI) and annual fisheries M/SI are mean annual figures for the period 2016–2020. Nest = estimated abundance, CV = coefficient of variation, Nmin = minimum abundance estimate, Rmax = maximum productivity rate, Fr = recovery factor, PBR = potential biological removal, unk = unknown, and undet = undetermined (PBR for species with outdated abundance estimates is considered "undetermined").

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
1	North Atlantic right whale	Western North Atlantic	Y	338	0	332	0.04	0.1	0.7	31.2[a]	22[a]	Y	2021	2020		NEC
2	Humpback whale	Gulf of Maine	N	1,396	0	1,380	0.065	0.5	22	12.15	7.75	N	2019	2016		NEC
3	Fin whale	Western North Atlantic	N	6,802	0.24	5,573	0.04	0.1	11	1.8	1.4	Y	2021	2016		NEC
4	Sei whale	Nova Scotia	N	6,292	1.02	3,098	0.04	0.1	6.2	0.8	0.4	Y	2021	2016		NEC
5	Minke whale	Canadian East Coast	N	21,968	0.31	17,002	0.04	0.5	170	10.6	9.65	N	2021	2016		NEC
6	Blue whale	Western North Atlantic	N	unk	unk	402	0.04	0.1	0.8	0	0	Y	2019	1980–2008		NEC
7	Sperm whale	North Atlantic	N	4,349	0.28	3,451	0.04	0.1	3.9	0	0	Y	2019	2016		NEC
8	Dwarf sperm whale	Western North Atlantic	N	7,750	0.38	5,689	0.04	0.4	46	0	0	N	2019	2016	Estimate for *Kogia spp.* Only.	SEC
9	Pygmy sperm whale	Western North Atlantic	N	7,750	0.38	5,689	0.04	0.4	46	0	0	N	2019	2016	Estimate for *Kogia spp.* Only.	SEC
10	Killer whale	Western North Atlantic	N	unk	unk	unk	0.04	0.5	unk	0	0	N	2014	2016		NEC
11	Pygmy killer whale	Western North Atlantic	N	unk	unk	unk	0.04	0.5	unk	0	0	N	2019	2016		SEC
12	False killer whale	Western North Atlantic	N	1,791	0.56	1,154	0.04	0.5	12	0	0	N	2019	2016		SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
13	Northern bottlenose whale	Western North Atlantic	N	unk	unk	unk	0.04	0.5	unk	0	0	N	2014	2016		NEC
14	Cuvier's beaked whale	Western North Atlantic	N	5,744	0.36	4,282	0.04	0.5	43	0.2	0	N	2019	2016		NEC
15	Blainville's beaked whale	Western North Atlantic	N	10,107	0.27	8,085	0.04	0.5	81	0.2	0	N	2019	2016	Estimates for *Mesoplodon spp.*	NEC
16	Gervais beaked whale	Western North Atlantic	N	10,107	0.27	8,085	0.04	0.5	81	0	0	N	2019	2016	Estimates for *Mesoplodon spp.*	NEC
17	Sowerby's beaked whale	Western North Atlantic	N	10,107	0.27	8,085	0.04	0.5	81	0	0	N	2019	2016	Estimates for *Mesoplodon spp.*	NEC
18	True's beaked whale	Western North Atlantic	N	10,107	0.27	8,085	0.04	0.5	81	0.2	0.2	N	2019	2016	Estimates for *Mesoplodon spp.*	NEC
19	Melon-headed whale	Western North Atlantic	N	unk	unk	unk	0.04	0.5	unk	0	0	N	2019	2016		SEC
20	Risso's dolphin	Western North Atlantic	N	35,215	0.19	30,051	0.04	0.5	301	34	34 (0.09)	N	2021	2016		NEC
21	Pilot whale, long-finned	Western North Atlantic	N	39,215	0.30	30,627	0.04	0.5	306	9	9 (0.4)	N	2021	2016		NEC
22	Pilot whale, short-finned	Western North Atlantic	N	28,924	0.24	23,637	0.04	0.5	236	136	136 (0.14)	N	2021	2016		SEC
23	Atlantic white-sided dolphin	Western North Atlantic	N	93,233	0.71	54,443	0.04	0.5	544	27	27 (0.21)	N	2021	2016		NEC
24	White-beaked dolphin	Western North Atlantic	N	536,016	0.31	415,344	0.04	0.5	4,153	0	0	N	2019	2016		NEC
25	Common dolphin	Western North Atlantic	N	172,974	0.21	145,216	0.04	0.5	1,452	390	390 (0.11)	N	2021	2016		NEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
26	Atlantic spotted dolphin	Western North Atlantic	N	39,921	0.27	32,032	0.04	0.5	320	0	0	N	2019	2016		SEC
27	Pantropical spotted dolphin	Western North Atlantic	N	6,593	0.52	4,367	0.04	0.5	44	0	0	N	2019	2016		SEC
28	Striped dolphin	Western North Atlantic	N	67,036	0.29	52,939	0.04	0.5	529	0	0	N	2019	2016		NEC
29	Fraser's dolphin	Western North Atlantic	N	unk	unk	unk	0.04	0.5	unk	0	0	N	2019	2016		SEC
30	Rough-toothed dolphin	Western North Atlantic	N	136	1.0	67	0.04	0.5	0.7	0	0	N	2018	2016		SEC
31	Clymene dolphin	Western North Atlantic	N	4,237	1.03	2,071	0.04	0.5	21	0	0	N	2019	2016		SEC
32	Spinner dolphin	Western North Atlantic	N	4,102	0.99	2,045	0.04	0.5	20	0	0	N	2019	2016		SEC
33	Common bottlenose dolphin	Western North Atlantic, Offshore	N	62,851	0.23	51,914	0.04	0.5	519	28	28 (0.34)	N	2019	2016	Estimates may include sightings of the coastal form.	SEC
34	Common bottlenose dolphin	Western North Atlantic, Northern Migratory Coastal	N	6,639	0.41	4,759	0.04	0.5	48	12.2–21.5	12.2–21.5	Y	2020	2016		SEC
35	Common bottlenose dolphin	Western North Atlantic, Southern Migratory Coastal	N	3,751	0.60	2,353	0.04	0.5	24	0–18.3	0–18.3	Y	2020	2016		SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
36	Common bottlenose dolphin	Western North Atlantic, S. Carolina, Georgia Coastal	N	6,027	0.34	4,569	0.04	0.5	46	1.4–1.6	1.0–1.2	Y	2017	2016		SEC
37	Common bottlenose dolphin	Western North Atlantic, Northern Florida Coastal	N	877	0.49	595	0.04	0.5	6.0	0.6	0	Y	2017	2016		SEC
38	Common bottlenose dolphin	Western North Atlantic, Central Florida Coastal	N	1,218	0.35	913	0.04	0.5	9.1	0.4	0.4	Y	2017	2016		SEC
39	Common bottlenose dolphin	Northern North Carolina Estuarine System	N	823	0.06	782	0.04	0.5	7.8	7.2–30	7.0–29.8	Y	2020	2013		SEC
40	Common bottlenose dolphin	Southern North Carolina Estuarine System	N	unk	unk	unk	0.04	0.5	undet	0.4	0.4	Y	2020	2006		SEC
41	Common bottlenose dolphin	Northern South Carolina Estuarine System	Y	453	0.28	359	0.04	0.5	3.6	0.5	0.3	N	2015	2016		SEC
42	Common bottlenose dolphin	Charleston Estuarine System	Y	unk	unk	unk	0.04	0.5	undet	2.2	1.8	Y	2015	2005, 2006		SEC

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43	Common bottlenose dolphin	Northern Georgia, Southern South Carolina Estuarine System	Y	unk	unk	unk	0.04	0.5	unk	1.5	1.3	Y	2015	n/a		SEC
44	Common bottlenose dolphin	Central Georgia Estuarine System	Y	unk	unk	unk	0.04	0.5	undet	0.4	0.2	Y	2015	2008, 2009		SEC
45	Common bottlenose dolphin	Southern Georgia Estuarine System	Y	unk	unk	unk	0.04	0.5	undet	0.1	0.1	Y	2015	2008, 2009		SEC
46	Common bottlenose dolphin	Jacksonville Estuarine System	Y	unk	unk	unk	0.04	0.5	unk	2.0	2.0	Y	2015	n/a		SEC
47	Common bottlenose dolphin	Indian River Lagoon Estuarine System	Y	1,032	0.03	1,004	0.04	0.5	10	5.7	3.0	Y	2015	2016, 2017		SEC
48	Common bottlenose dolphin	Biscayne Bay	Y	unk	unk	unk	0.04	0.5	unk	0.8	0.6	Y	2013	n/a		SEC
49	Harbor porpoise	Gulf of Maine, Bay of Fundy	N	95,543	0.31	74,034	0.046	0.5	851	164	163 (0.13)	N	2021	2016		NEC
50	Harbor seal	Western North Atlantic	N	61,336	0.08	57,637	0.12	0.5	1,729	339	334 (0.09)	N	2021	2018		NEC
51	Gray seal	Western North Atlantic	N	27,300	0.22	22,785	0.128	1.0	1,458	4,453	1,169 (0.10)	N	2021	2016		NEC
52	Harp seal	Western North Atlantic	N	7.6M	unk	7.1M	0.12	1.0	426,000	178,573	86 (0.16)	N	2021	2019		NEC
53	Hooded seal	Western North Atlantic	N	unk	unk	unk	0.12	0.75	unk	1,680	0.6 (1.12)	N	2018	n/a		NEC

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54	Sperm whale	Gulf of Mexico	N	1,180	0.22	983	0.04	0.1	2.0	9.6	0.2 (1.0)	Y	2020	2017, 2018		SEC
55	Rice's whale	Gulf of Mexico	Y	51	0.5	34	0.04	0.1	0.1	0.5	0	Y	2020	2017, 2018	Total M/SI is a minimum estimate and does not include Fisheries M/SI.	SEC
56	Cuvier's beaked whale	Gulf of Mexico	N	18	0.75	10	0.04	0.5	0.1	5.2	0	N	2020	2017, 2018		SEC
57	Blainville's beaked whale	Gulf of Mexico	N	98	0.46	68	0.04	0.5	0.7	5.2	0	N	2020	2017, 2018	Estimates for *Mesoplodon spp.*	SEC
58	Gervais' beaked whale	Gulf of Mexico	N	20	0.98	10	0.04	0.5	0.1	5.2	0	N	2020	2017, 2018		SEC
59	Common bottlenose dolphin	Gulf of Mexico, Continental Shelf	N	63,280	0.11	57,917	0.04	0.48	556	65	64.6	N	2021	2017, 2018	M/S is a minimum count and does not include projected mortality estimates for 2015–2019 due to the DWH oil spill.	SEC
60	Common bottlenose dolphin	Gulf of Mexico, Eastern Coastal	N	16,407	0.17	14,199	0.04	0.4	114	9.2	8.8	N	2021	2017, 2018		SEC
61	Common bottlenose dolphin	Gulf of Mexico, Northern Coastal	N	11,543	0.19	9,881	0.04	0.45	89	28	7.9	N	2021	2017, 2018		SEC
62	Common bottlenose dolphin	Gulf of Mexico, Western Coastal	N	20,759	0.13	18,585	0.04	0.45	167	36	32.4	N	2021	2017, 2018		SEC
63	Common bottlenose dolphin	Gulf of Mexico, Oceanic	N	7,462	0.31	5,769	0.04	0.5	58	32	0	N	2020	2017, 2018		SEC
64	Common bottlenose dolphin	Laguna Madre	N	80	1.57	unk	0.04	0.4	undet	0.8	0.2	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
65	Common bottlenose dolphin	Neuces Bay, Corpus Christi Bay	N	58	0.61	unk	0.04	0.4	undet	0.2	0	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
66	Common bottlenose dolphin	Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay	N	55	0.82	unk	0.04	0.4	undet	0.6	0	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
67	Common bottlenose dolphin	Matagorda Bay, Tres Palacios Bay, Lavaca Bay	N	61	0.45	unk	0.04	0.4	undet	0.4	0	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
68	Common bottlenose dolphin	West Bay	N	37	0.05	35	0.04	0.4	0.3	0	0	N	2021	2014, 2015		SEC
69	Common bottlenose dolphin	Galveston Bay, East Bay, Trinity Bay	N	842	0.08	787	0.04	0.4	6.3	1.0	0.4	N	2021	2016		SEC
70	Common bottlenose dolphin	Sabine Lake	N	122	0.19	104	0.04	0.45	0.9	0	0	N	2021	2017	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC

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71	Common bottlenose dolphin	Calcasieu Lake	N	0	-	-	0.04	0.45	undet	0.2	0.2	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
72	Common bottlenose dolphin	Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay	N	0	-	-	0.04	0.45	undet	0	0	Y	2021	1992	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
73	Common bottlenose dolphin	Terrebonne, Timbalier Bay Estuarine System	N	3,870	0.15	3,426	0.04	0.4	27	0.2	0	N	2018	2016		SEC
74	Common bottlenose dolphin	Barataria Bay Estuarine System	N	2,071	0.06	1,971	0.04	0.45	18	41	0	Y	2021	2019		SEC
75	Common bottlenose dolphin	Mississippi River Delta	N	1,446	0.19	1,238	0.04	0.4	11	9.2	0.2	N	2021	2017–2018	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
76	Common bottlenose dolphin	Mississippi Sound, Lake Borgne, Bay Boudreau	N	1,265	0.35	947	0.04	0.45	8.5	59	2.0	Y	2021	2018		SEC

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77	Common bottlenose dolphin	Mobile Bay, Bonsecour Bay	N	122	0.34	unk	0.04	0.45	undet	16.0	1.0	Y	2021	1993	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
78	Common bottlenose dolphin	Perdido Bay	N	0	-	-	0.04	0.4	undet	0.8	0.6	Y	2021	1993	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
79	Common bottlenose dolphin	Pensacola Bay, East Bay	N	33	0.80	unk	0.04	0.4	undet	0.4	0.2	Y	2021	1993	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
80	Common bottlenose dolphin	Choctawhatchee Bay	N	179	0.04	unk	0.04	0.5	undet	0.4	0	Y	2015	2007		SEC
81	Common bottlenose dolphin	St. Andrew Bay	N	199	0.09	185	0.04	0.4	1.5	0.2	0.2	N	2019	2016		SEC
82	Common bottlenose dolphin	St. Joseph Bay	N	142	0.17	123	0.04	0.4	1.0	unk	unk	N	2019	2011		SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
83	Common bottlenose dolphin	St. Vincent Sound, Apalachicola Bay, St. George Sound	N	439	0.14	unk	0.04	0.4	undet	0.2	0.2	Y	2021	2007	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
84	Common bottlenose dolphin	Apalachee Bay	N	491	0.39	unk	0.04	0.4	undet	0	0	Y	2021	1993	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
85	Common bottlenose dolphin	Waccasassa Bay, Withla-coochee Bay, Crystal Bay	N	unk	-	unk	0.04	0.4	undet	0.4	0.4	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
86	Common bottlenose dolphin	St. Joseph Sound, Clearwater Harbor	N	unk	-	unk	0.04	0.4	undet	0.8	0.4	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
87	Common bottlenose dolphin	Tampa Bay	N	unk	-	unk	0.04	0.4	undet	3.0	2.2	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
88	Common bottlenose dolphin	Sarasota Bay, Little Sarasota Bay	N	158	0.27	126	0.04	0.4	1.0	0.2	0.2	N	2021	2015	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
89	Common bottlenose dolphin	Pine Island Sound, Charlotte Harbor, Gasparilla Sound, Lemon Bay	N	826	0.09	unk	0.04	0.4	undet	1.0	0.6	Y	2021	2006	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
90	Common bottlenose dolphin	Caloosa-hatchee River	N	0	-	-	0.04	0.4	undet	0.4	0.2	Y	2021	1985	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
91	Common bottlenose dolphin	Estero Bay	N	unk	-	unk	0.04	0.4	undet	0.4	0.2	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
92	Common bottlenose dolphin	Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	N	unk	-	unk	0.04	0.4	undet	0.2	0.2	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
93	Common bottlenose dolphin	Whitewater Bay	N	unk	-	unk	0.04	0.4	undet	0	0	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
94	Common bottlenose dolphin	Florida Bay	Y	unk	unk	unk	0.04	0.5	unk	0.2	0.2	N	2013	2003		SEC
95	Common bottlenose dolphin	Florida Keys (Bahia Honda to Key West)	N	unk	-	unk	0.04	0.4	undet	0.2	0.2	Y	2021	n/a	Details for this stock are included in the collective report: Common bottlenose dolphin (*Tursiops truncatus truncatus*), Northern Gulf of Mexico Bay, Sound, and Estuary Stocks.	SEC
96	Atlantic spotted dolphin	Gulf of Mexico	N	21,506	0.26	17,339	0.04	0.48	166	36	36 (0.47)	N	2021	2017, 2018	M/S is a minimum count and does not include projected mortality estimates for 2015–2019 due to the DWH oil spill.	SEC
97	Pantropical spotted dolphin	Gulf of Mexico	N	37,195	0.24	30,377	0.04	0.5	304	241	0	N	2020	2017, 2018		SEC
98	Striped dolphin	Gulf of Mexico	N	1,817	0.56	1,172	0.04	0.5	12	13	0	Y	2020	2017, 2018		SEC
99	Spinner dolphin	Gulf of Mexico	N	2,991	0.54	1,954	0.04	0.5	20	113	0	Y	2020	2017, 2018		SEC
100	Rough-toothed dolphin	Gulf of Mexico	N	unk	n/a	unk	0.04	0.4	undet	39	0.8 (1.00)	N	2020	2017, 2018		SEC
101	Clymene dolphin	Gulf of Mexico	N	513	1.03	250	0.04	0.5	2.5	8.4	0	Y	2020	2017, 2018		SEC
102	Fraser's dolphin	Gulf of Mexico	N	213	1.03	104	0.04	0.5	1.0	unk	0	N	2020	2017, 2018		SEC
103	Killer whale	Gulf of Mexico	N	267	0.75	152	0.04	0.5	1.5	unk	0	N	2020	2017, 2018		SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
104	False killer whale	Gulf of Mexico	N	494	0.79	276	0.04	0.5	2.8	2.2	0	N	2020	2017, 2018		SEC
105	Pygmy killer whale	Gulf of Mexico	N	613	1.15	283	0.04	0.5	2.8	1.6	0	N	2020	2017, 2018		SEC
106	Dwarf sperm whale	Gulf of Mexico	N	336	0.35	253	0.04	0.5	2.5	31	0	N	2020	2017, 2018	Estimate for *Kogia spp.* only.	SEC
107	Pygmy sperm whale	Gulf of Mexico	N	336	0.35	253	0.04	0.5	2.5	31	0	N	2020	2017, 2018	Estimate for *Kogia spp.* only.	SEC
108	Melon-headed whale	Gulf of Mexico	N	1,749	0.68	1,039	0.04	0.5	10	9.5	0	N	2020	2017, 2018		SEC
109	Risso's dolphin	Gulf of Mexico	N	1,974	0.46	1,368	0.04	0.5	14	5.3	0	N	2020	2017, 2018		SEC
110	Pilot whale, short-finned	Gulf of Mexico	N	1,321	0.43	934	0.04	0.4	7.5	3.9	0.4 (1.00)	N	2020	2017, 2018	Nbest includes all *Globicephala sp.*, though it is presumed that only short-finned pilot whales are present in the Gulf of Mexico.	SEC
111	Sperm Whale	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.1	unk	unk	unk	Y	2010	n/a		SEC
112	Common bottlenose dolphin	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	2011	n/a		SEC
113	Cuvier's beaked whale	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	2011	n/a		SEC
114	Pilot whale, short-finned	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	2011	n/a		SEC
115	Spinner dolphin	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	2011	n/a		SEC

ID	Species	Stock Area	Updated this Year	Nest	Nest CV	Nmin	Rmax	Fr	PBR	Total Annual M/SI	Annual Fish. M/SI (CV)	Strategic Status	SAR of Last Update	Last Survey Year	Comments	NMFS Ctr.
116	Atlantic spotted dolphin	Puerto Rico and U.S. Virgin Islands	N	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	2011	n/a		SEC

a. Total annual average observed North Atlantic right whale mortality during the period 2016–2020 was 8.1 animals and annual average observed fishery mortality was 5.7 animals. Numbers presented in this table (31.2 total mortality and 22 fishery mortality) are 2015–2019 estimated annual means, accounting for undetected mortality and serious injury.

NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*): Western Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The western North Atlantic right whale population ranges primarily from calving grounds in coastal waters of the southeastern U.S. to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence (Figure 1). Mellinger *et al.* (2011) reported acoustic detections of right whales near the nineteenth-century whaling grounds east of southern Greenland, but the number of whales and their origin is unknown. Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. Resightings of photographically identified individuals have been made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton *et al*. 2007), in northern Norway (Jacobsen *et al.* 2004), in the Azores (Silva *et al.* 2012), and off Brittany in northwestern France (New England Aquarium unpub. catalog record). These long-range matches indicate an extended range for at least some individuals. Records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al*. 1972; Ward-Geiger *et al*. 2011) represent individuals beyond the primary calving and wintering ground in the waters of the southeastern U.S. East Coast.

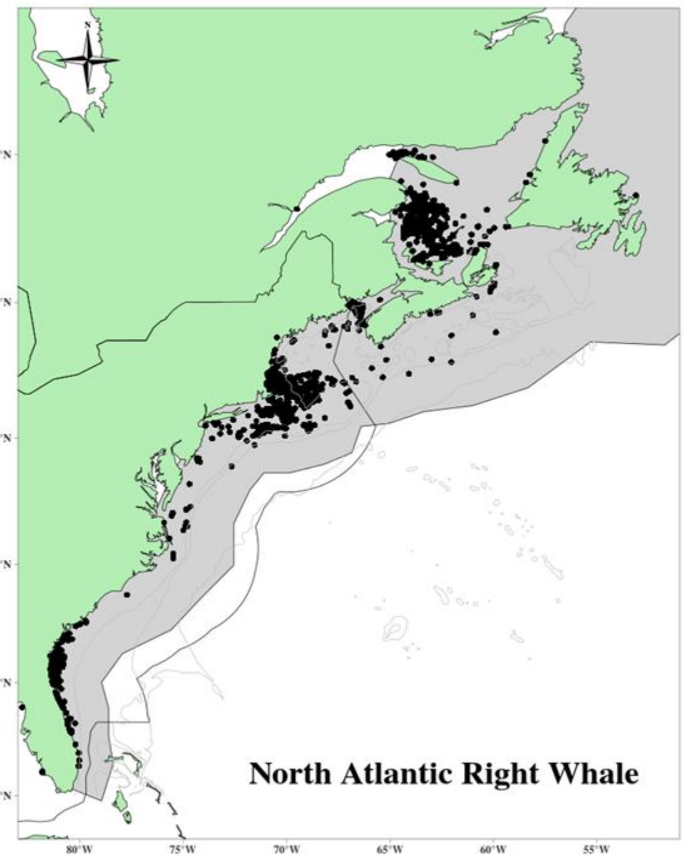

Figure 1. Approximate range (shaded area) and distribution of sightings (dots) of known North Atlantic right whales.

Although the location of much of the population is unknown during much of the year, passive acoustic studies of right whales have demonstrated their year-round presence in the Gulf of Maine (Morano *et al*. 2012; Bort *et al*. 2015), New Jersey (Whitt *et al*. 2013), and Virginia (Salisbury *et al*. 2016). Additionally, right whales were acoustically detected off Georgia and North Carolina in 7 of 11 months monitored (Hodge *et al*. 2015). Davis *et al*. (2017) pooled together detections from a large number of passive acoustic devices and documented broad-scale use of the U.S. eastern seaboard during much of the year. In Canada, Simard *et al*. (2019) documented the frequency of right whale contact calls in the Gulf of St. Lawrence from June 2010 to November 2018 using a year-round passive acoustic network. Acoustic detections indicated right whale presence every year. The earliest detections were at the end of April and the latest in mid-January, with peak occurrence between August and the end of October. Detections were focused in the southern Gulf, and daily detection rates quadrupled at listening stations off the Gaspé Peninsula beginning in 2015.

Individuals' movements within and between habitats across the range are extensive. In 2000, one whale was photographed in Florida waters on 12 January, then again 11 days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March, effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Results from satellite-tagging studies clearly indicate that sightings separated by a few weeks in the same area should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown lengthy excursions, including into deep water off the continental shelf over short timeframes (Mate *et al*. 1997; Baumgartner and Mate 2005).

Systematic visual surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves, suggesting the calving grounds may extend as far north as Cape Fear (W.A. McLellan, Univ. of North Carolina Wilmington, pers. comm.). Four of those calves were not sighted by surveys conducted farther south. One of the females photographed was new to researchers, having effectively eluded identification over the period of its maturation. In 2016, the Southeastern U.S. Calving Area Critical Habitat was expanded north to Cape Fear, North Carolina. There is also at least one case of a calf apparently being born in the Gulf of Maine (Patrician *et al*. 2009) and another neonate was detected in Cape Cod Bay in 2012 (Center for Coastal Studies, Provincetown, MA USA, unpub. data).

New England and Canadian waters are important feeding habitats for right whales, where they feed primarily on copepods (largely of the genera *Calanus* and *Pseudocalanus*). Right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney *et al*. 1986, 1995). The characteristics of acceptable prey distribution in these areas are summarized in Baumgartner *et al*. (2003) and Baumgartner and Mate (2003). In 2016, the Northeastern U.S. Foraging Area Critical Habitat was expanded to include nearly all U.S. waters of the Gulf of Maine (81 FR 4837, 26 February 2016).

An important shift in habitat-use patterns in 2010 was highlighted in an analysis of right whale acoustic presence in the western North Atlantic from 2004 to 2014 (Davis *et al*. 2017). This shift was also reflected in visual survey data in the greater Gulf of Maine region. Between 2012 and 2016, visual surveys detected fewer individuals in the Great South Channel (NMFS unpublished data) and the Bay of Fundy (Davies *et al*. 2019), while the number of individuals using Cape Cod Bay in spring increased (Mayo *et al*. 2018; Ganley *et al*. 2019). In addition, right whales apparently abandoned the central Gulf of Maine in winter (see Cole *et al*. 2013), but have since been seen in large numbers, and both feeding and socializing observed, in a region south of Martha's Vineyard and Nantucket Islands (Leiter *et al*. 2017; Stone *et al*. 2017; Quintana-Rizzo *et al*. 2021), an area outside of the 2016 Northeastern U.S. Foraging Area Critical Habitat. Right whale presence in this area is nearly year round, including in summer months. The highest sighting rates are from winter through early spring; close to a quarter of the population may be present at any given time between December and May. The age and sex of the whales using this area did not vary significantly from that of the population (Quintana-Rizzo *et al.* 2021). Since 2015, increased acoustic detections and survey effort in the Gulf of St. Lawrence have documented right whale presence there from late spring through the fall (Cole *et al*. 2016; Simard *et al*. 2019; DFO 2020). Photographic captures of right whales in the Gulf of St. Lawrence during the summers of 2015–2019 documented 48, 50, 133, 132, and 135 unique individuals using the region, respectively, with a total of 187 unique individuals documented over the five summers (Crowe *et al*. 2021).

Genetic analyses based upon direct sequencing of mitochondrial DNA (mtDNA) have identified seven mtDNA haplotypes in the western North Atlantic right whale population, including heteroplasmy that led to the declaration of the seventh haplotype (Malik *et al*. 1999; McLeod and White 2010). Schaeff *et al*. (1997) compared the genetic variability of North Atlantic and southern right whales (*E. australis*), and found the former to be significantly less diverse, a finding broadly replicated by Malik *et al*. (2000). The low diversity in North Atlantic right whales might indicate inbreeding, but no definitive conclusion can be reached using current data. Modern and historic genetic population structures were compared using DNA extracted from museum and archaeological specimens of baleen and bone. This work suggested that the eastern and western North Atlantic populations were not genetically distinct (Rosenbaum *et al*. 1997, 2000). However, the virtual extirpation of the eastern stock and its lack of recovery in the last hundred years strongly suggest population subdivision over a protracted (but not evolutionary) timescale. Genetic studies concluded that the principal loss of genetic diversity occurred prior to the 18th century (Waldick *et al*. 2002). However, revised conclusions that nearly all the remains in the North American Basque whaling archaeological sites were bowhead whales (*Balaena mysticetus*) and not right whales (Rastogi *et al*. 2004; McLeod *et al*. 2008) contradict the previously held belief that Basque whaling during the 16th and 17th centuries was principally responsible for the loss of genetic diversity.

High-resolution (*i.e.*, using 35 microsatellite loci) genetic profiling improved the understanding of genetic variability, the number of reproductively active individuals, reproductive fitness, parentage, and relatedness of individuals (Frasier *et al*. 2007, 2009). It has also helped fill gaps in our understanding of the species' age structure, calf development, calf survival, and weaning (Hamilton *et al*. 2022). Because the callosity patterns used to identify individual right whales take months to develop after a whale's birth, obtaining biopsy samples from calves on the calving grounds provides a means of genetically identifying calves later in life, or death. Between 1990 and 2010, only about 60% of all known calves were seen with their mothers in summering areas when their callosity patterns are stable enough to reliably make a photo-ID match later in life. The remaining 40% were not seen on a known summering ground. Because the calf's genetic profile is the most reliable way to establish parentage, if the calf is not sampled when associated with its mother early on, information such as age and familial relationships may be lost. From 1980 to 2001, there were 64 calves born that were not sighted later with their mothers and thus unavailable to provide age-specific mortality information (Frasier *et al*. 2007). Hamilton *et al*. (2022) reported that of the 470 calves observed between 1998 and 2018, 370 (78.7%) were biopsied, 293 as calves and 77 later in life, their identification linked by photographs. Of the 100 calves not biopsied during this period, 32 were sufficiently photographed to allow subsequent identification and aging, but 68 had yet to be identified other than as a unique calf.

Frasier (2007b) genetically examined the paternity of 87 calves born between 1980 and 2001. Although genetic profiles were available for 69% of all potential fathers in the population, paternity was assigned to only 51% of the calves, and all the sampled males were excluded as fathers of the remaining calves. The findings suggested that either the unsampled males were particularly successful, or that the population of males, and the population as a whole, was larger than suggested by the photo-identification data (Frasier 2007b). However, a study comparing photo-identification and pedigree genetic data for animals known or presumed to be alive during 1980–2016 found that the presumed alive estimate is similar to the actual abundance of this population, which indicates that the majority of the animals have been photo-identified (Fitzgerald 2018).

POPULATION SIZE

Estimation of the western North Atlantic right whale stock size is based on a published state-space model of the sighting histories of individual whales identified using photo-identification techniques (Pace *et al*. 2017; Pace 2021). Sightings histories were constructed from the photo-ID recapture database as it existed in December 2021, and included photographic information up through November 2020. Using a hierarchical, state-space Bayesian open population model of these histories produced a median abundance value (Nest) as of 30 November 2020 of 338 individuals (95%CI: 325-350; Table 1). As with any statistically-based estimation process, uncertainties exist in the estimation of abundance because it is based on a probabilistic model that makes certain assumptions about the structure of the data. Because the statistically-based uncertainty is asymmetric about N, the credible interval is used to characterize that uncertainty (as opposed to a CV that may appear in other stock assessment reports).

Table 1. Best and minimum abundance estimates as of 30 November 2020 for the western North Atlantic right whale (Eubalaena glacialis) with Maximum Productivity Rate (R_{max}), Recovery Factor (F_r) and PBR.

N_{est}	95% Credible Interval	60% Credible Interval	N_{min}	F_r	R_{max}	PBR
338	325–350	332–343	332	0.1	0.04	0.7

Historical Abundance

The total North Atlantic right whale population size pre-whaling is estimated between 9,075 and 21,328 based on extrapolation of spatially explicit models of carrying capacity in the North Pacific (Monserrat *et al.* 2015). Basque whalers were thought to have taken right whales during the 1500s in the Strait of Belle Isle region (Aguilar 1986), however, genetic analysis has shown that nearly all of the remains found in that area are, in fact, those of bowhead whales (Rastogi *et al.* 2004; Frasier *et al.* 2007). This stock of right whales may have already been substantially reduced by the time colonists in Massachusetts started whaling in the 1600s (Reeves *et al.* 2001, 2007). A modest but persistent whaling effort along the coast of the eastern U.S. lasted three centuries, and the records include one report of 29 whales killed in Cape Cod Bay in a single day in January 1700. Reeves *et al*. (2007) calculated that a minimum of 5,500 right whales were taken in the western North Atlantic between 1634 and 1950, with nearly 80% taken in a

50-year period between 1680 and 1730. They concluded "there were at least a few thousand whales present in the mid-1600s." The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered fewer than 100 individuals by 1935 when international protection for right whales came into effect (Hain 1975; Reeves *et al.* 1992; Kenney *et al.* 1995). However, little is known about the population dynamics of right whales in the intervening years.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% credible interval about the median of the posterior abundance estimates using the methods of Pace *et al*. (2017) and refinements of Pace (2021). This is roughly equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The median estimate of abundance for western North Atlantic right whales is 338 (computed November 30, 2021). The minimum population estimate as of 30 November 2020 is 332 individuals (Table 1).

Current Population Trend

The population growth rate reported for the period 1986–1992 by Knowlton *et al.* (1994) was 2.5% (CV=0.12), suggesting that the stock was recovering slowly, but that number may have been influenced by the discovery phenomenon as existing whales were recruited to the catalog. Work by Caswell *et al.* (1999) suggested that crude survival probability declined from about 0.99 in the early 1980s to about 0.94 in the late 1990s. The decline was statistically significant. Additional work conducted in 1999 was reviewed by an IWC workshop on status and trends in this population (IWC 2001); the workshop concluded based on several analytical approaches that survival had indeed declined in the 1990s. Although capture heterogeneity could negatively bias survival estimates, the workshop concluded that this factor could not account for the entire observed decline, which appeared to be particularly marked in adult females. Another workshop was convened by NMFS in September 2002, and it reached similar conclusions regarding the decline in the population (Clapham 2002). At the time, the early part of the recapture series had not been examined for excessive retrospective recaptures which had the potential to positively bias the earliest estimates of survival as the catalog was being developed.

Examination of the abundance estimates for the years 1990–2011 (Figures 2a, 2b) suggests that abundance increased at about 2.8% per annum from posterior median point estimates of 270 individuals in 1990 to 481 in 2011, but that there was a 100% chance that abundance declined from 2011 to 2020 when the final estimate was 338 individuals. The overall abundance decline between 2011 and 2020 was 23.5% (CI=21.4% to 26.0%). There has been a considerable change in right whale habitat-use patterns in areas where most of the population had been observed in previous years (*e.g.*, Davies *et al*. 2017), exposing the population to new anthropogenic threats (Hayes *et al.* 2018). Pace (2021) found a significant decrease in mean survival rates since 2010, correlating with the observed change in area-use patterns (Figure 2c). This apparent change in habitat use also had the effect that, despite relatively constant effort to find whales in traditional areas, the chance of photographically capturing individuals decreased (Figure 3). However, the methods in Pace *et al.* (2017) and Pace (2021) account for changes in capture probability.

There were 17 right whale mortalities reported in 2017 (Daoust *et al.* 2017). This number exceeds the largest estimated annual mortality rate during the past 25 years. Further, despite high survey effort, only 5 and 0 calves were detected in 2017 and 2018, respectively. In 2019, 7 calves were identified, and in 2020 10 calves were documented (Pettis *et al.* 2021).

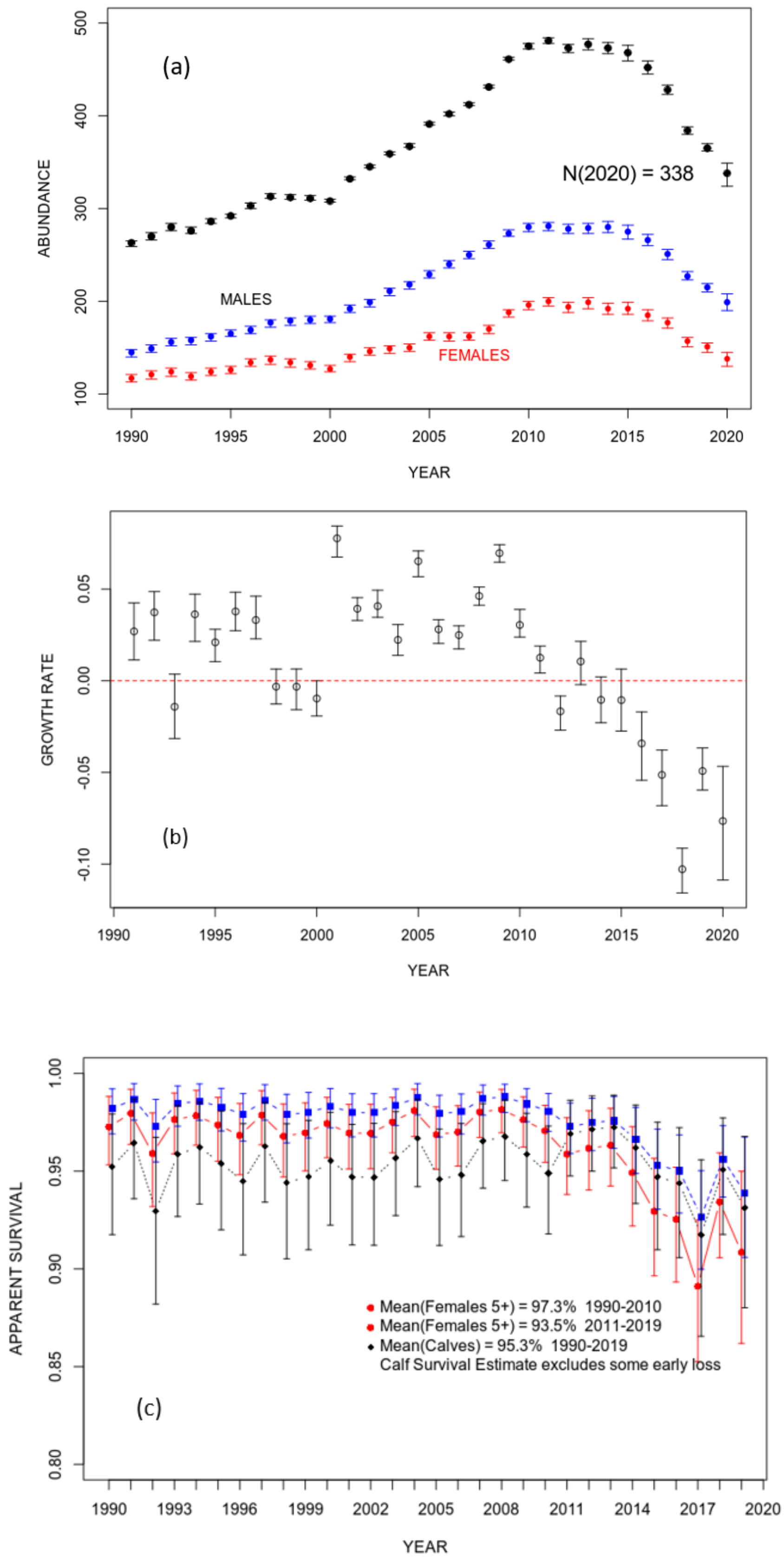
(a)
ABUNDANCE
N(2020) = 338
MALES
FEMALES
YEAR
(b)
GROWTH RATE
YEAR
(c)
APPARENT SURVIVAL
Mean(Females 5+) = 97.3% 1990-2010
Mean(Females 5+) = 93.5% 2011-2019
Mean(Calves) = 95.3% 1990-2019
Calf Survival Estimate excludes some early loss
YEAR

Figure 2. (a) Abundance estimates for North Atlantic right whales. Estimates are the median values of a posterior distribution from modeled capture histories. Also shown are sex-specific abundance estimates. Cataloged whales may include some but not all calves produced each year. (b) Annual growth rates from the abundance values (c) Sex-specific survival rate estimates. All graphs show associated 95% credible intervals.

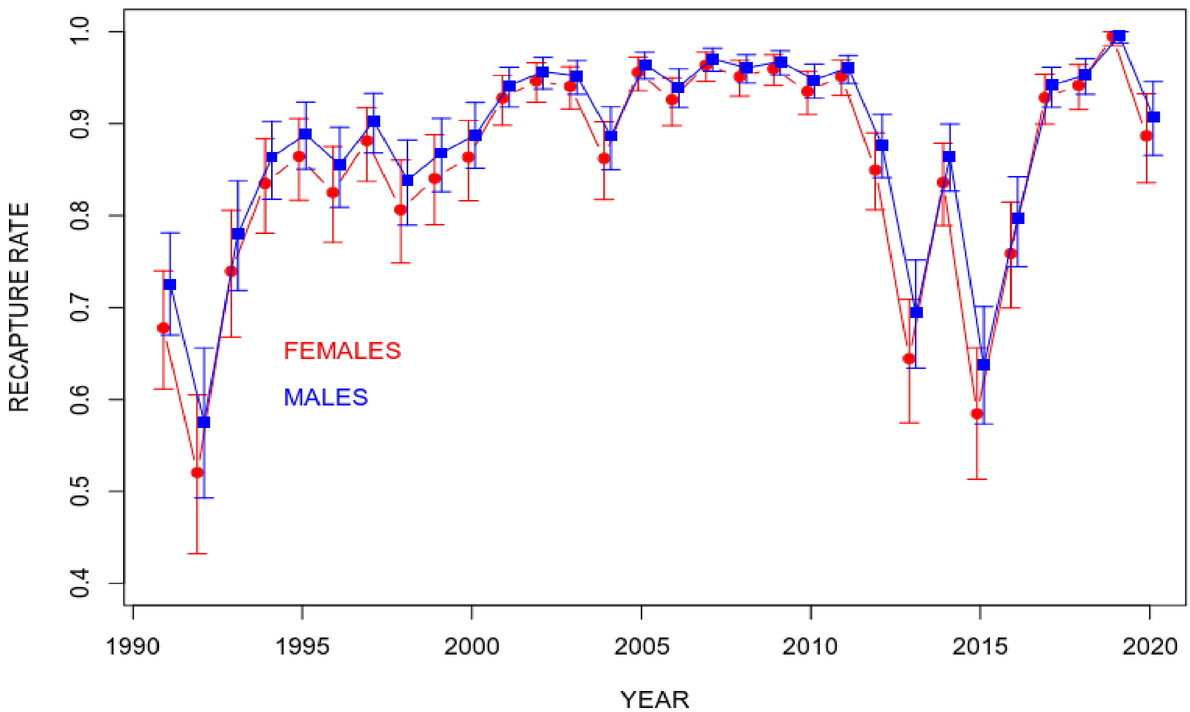

Figure 3. Estimated recapture probability and associated 95% credible intervals of North Atlantic right whales 1990–2018 based on a Bayesian mark-resight/recapture model allowing random fluctuation among years for survival rates, treating capture rates as fixed effects over time, and using both observed and known states as data (from Pace et al. 2017). Males are shown in blue with squares, females are shown in red with circles.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

During 1980–1992, at least 145 calves were born to 65 identified females. The number of calves born annually ranged from 5 to 17, with a mean of 11.2 (SE=0.90). The reproductively active female pool was static at approximately 51 individuals during 1987–1992. Mean calving interval, based on 86 records, was 3.67 years. There was an indication that calving intervals may have been increasing over time, although the trend was not statistically significant (P=0.083) (Knowlton *et al.* 1994). Since 1993, calf production has been more variable than a simple stochastic model would predict.

During 1990–2020, at least 481 calves were born into the population. The number of calves born annually ranged from 0 to 39, and averaged 15 but was highly variable (SD=9.1). No calves were born in the winter of 2017–2018. The fluctuating abundance observed from 1990 to 2020 makes interpreting a count of calves by year less clear than measuring population productivity, which we index by dividing the number of detected calves by the estimated size of the population each year (Apparent Productivity Index or API). Productivity for this stock has been highly variable over time and has been characterized by periodic swings in per capita birth rates (Figure 4). Notwithstanding the high variability observed, as expected for a small population, productivity in North Atlantic right whales lacks a definitive trend. Corkeron *et al.* (2018) found that during 1990–2016, calf count rate increased at 1.98% per year with outlying years of very high and low calf production. This is approximately a third of that found for three different southern right whale (*Eubalaena australis)* populations during the same time period (5.3–7.2%). Based on the most recent population estimate, there are approximately 68 females known to have calved that are likely (>50% probability) still alive.

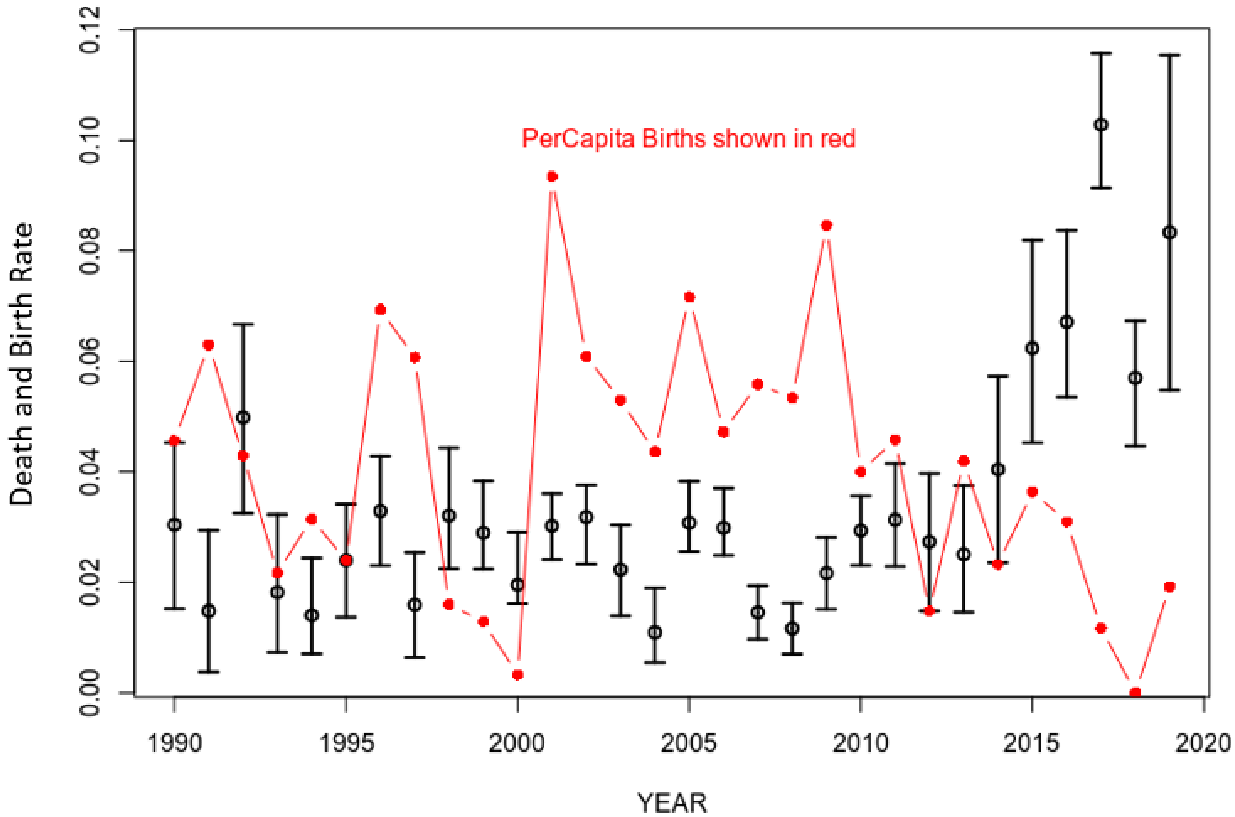

Figure 4. North Atlantic right whale per capita birth rate (red line, closed circles) and death rate with associated 95% credible intervals, 1990 – 2019.

The available evidence suggests that at least some of the observed variability in the calving rates of North Atlantic right whales is related to variability in nutrition (Fortune *et al.* 2013). There is also clear evidence that North Atlantic right whales are growing to shorter adult lengths than in earlier decades (Stewart *et al.* 2021) and are in poor body condition compared to southern right whales (Christiansen *et al.* 2020). All these changes may result from a combination of documented regime shifts in primary feeding habitats (Meyer-Gutbrod and Greeene 2014; Meyer-Gutbrod *et al.* 2021; Record *et al.* 2019), and increased energy expenditures related to non-lethal entanglements (Rolland *et al.* 2016; Pettis *et al.* 2017; van der Hoop 2017). Only non-lethal entanglements can be affected by management intervention, and despite recent management actions, overall entanglement rates (as measured by the rate at which scars are acquired by living North Atlantic right whales; Hamilton *et al.* 2020; Fig. 5 here) remain high. As such, entanglement will continue to impact calving rates, and the declining trend in abundance will likely continue.

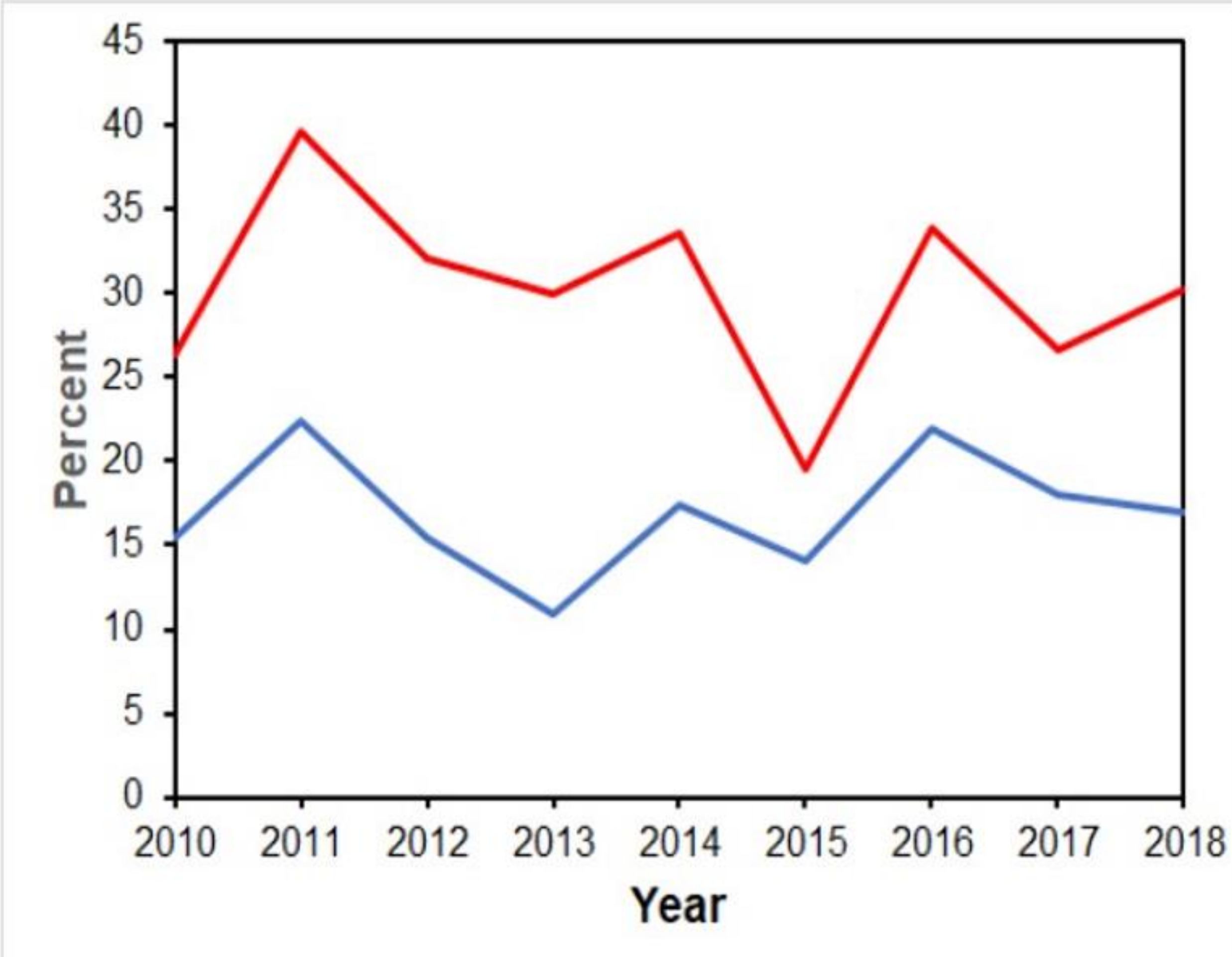

Figure 5. North Atlantic right whale entanglement rates estimated by monitoring scars on living whales. The crude entanglement rate (blue line) is the proportion of whales seen with newly discovered entanglement scars . The annual entanglement rate (red line) is the proportion of adequately photographed whales with new scars (data from Hamilton et al. 2020).

An analysis of the age structure of this population suggested that it contained a smaller proportion of juvenile whales than expected (Hamilton *et al.* 1998; IWC 2001), which may reflect lowered recruitment and/or high juvenile mortality. Calf and perinatal mortality was estimated by Browning *et al.* (2010) to be between 17 and 45 animals during the period 1989 and 2003. In addition, it is possible that the apparently low reproductive rate is due in part to an unstable age structure or to reproductive dysfunction in some females. However, few data are available on either factor and senescence has not been documented for any baleen whale.

The maximum net productivity rate is unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be the default value of 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995). Projection models suggest that this rate could be 4% per year if female survival was the highest recorded over the time series from Pace *et al.* (2017). Reviewing the available literature, Corkeron *et al.* (2018) showed that female mortality is primarily anthropogenic, and concluded that anthropogenic mortality has limited the recovery of North Atlantic right whales. In a similar effort, Kenney (2018) back-projected a series of scenarios that varied entanglement mortality from observed to zero. Using a scenario with zero entanglement mortality, which included 15 ‘surviving’ females, and a five-year calving interval, the projected population size including 26 additional calf births would have been 588 by 2016. Single-year production has exceeded 0.04 in this population several times, but those outputs are not likely sustainable given the 3-year minimum interval required between successful calving events and the small fraction of reproductively active females. This is likely related to synchronous calving that can occur in capital breeders under variable environmental conditions. Hence, uncertainty exists as to whether the default value is representative of maximum net productivity for this stock, but it is unlikely that it is much higher than the default.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum net productivity rate and a recovery factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The recovery factor for right whales is 0.1 because this species is listed as endangered under the Endangered Species Act (ESA). The minimum population size is 332. The maximum productivity rate is 0.04, the default value for cetaceans. PBR for the western North Atlantic stock of the North Atlantic right whale is 0.7 (Table 1).

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2016 through 2020, the annual detected (*i.e*., observed) human-caused mortality and serious injury to right whales averaged 8.1 individuals per year (Table 2). This is derived from two components: 1) incidental fishery entanglement records at 5.7 per year, and 2) vessel strike records averaging 2.4 per year.

Injury determinations are made based upon the best available information; these determinations may change with the availability of new information (Henry *et al. 2022*). Only records considered to be confirmed human-caused mortalities or serious injuries are reported in the observed mortality and serious injury (M/SI) rows of Table 2.

Annual rates calculated from detected mortalities are a negatively-biased accounting of human-caused mortality; they represent a definitive lower bound. Detections are irregular, incomplete, and not the result of a designed sampling scheme. Research on other cetaceans has shown the actual number of deaths can be several times higher than observed (Wells *et al.* 2015; Williams *et al*. 2011). The hierarchical Bayesian, state-space model used to estimate North Atlantic right whale abundance (Pace *et al.* 2017) can also be used to estimate total mortality. The estimated annual rate of total mortality using this modeling approach is 31.2 animals for the period 2015–2019 (Pace *et al.* 2021). This estimated total mortality accounts for detected mortality and serious injury (injuries likely to lead to death), as well as undetected (cryptic) mortality within the population. Figure 6 shows the estimates of total mortality for 1990–2019 from the state-space model. The estimated mortality rate for the 5-year period 2015–2019 using the methods of Pace *et al*. (2021) is 4.1 times higher than the 7.7 detected mortality and serious injury value reported for the same period in the previous stock assessment report. The estimated mortality for 2020 is not yet available because it is derived from a comparison with the population estimate for 2021, which, in turn, is contingent on the processing of all photographs collected through 2021 for incorporation into the state-space model of the sighting histories of individual whales. An analysis of right whale mortalities between 2003 and 2018 found that of the examined non-calf carcasses for which cause of death could be determined, all mortality was human-caused (Sharp *et al.* 2019). Based on these findings, 100% of the estimated mortality of 31.2 animals per year is assumed to be human-caused. This estimate of total annual human-caused mortality may be somewhat positively biased (*i.e*., a slight overestimate) given that some calf mortality is likely not human-caused.

There is currently insufficient information to apportion the estimated total right whale mortality occurring in U.S. waters. To apportion the estimated total right whale mortality by cause, *e.g*., entanglement versus vessel collision, we used the proportion of observed mortalities and serious injuries from entanglement compared to those from vessel collision for the period 2016–2020. During this period, 71% of the observed mortality and serious injury was the result of entanglement and 29% was from vessel collisions. Applying these proportions to the estimated total mortality provides an estimate of 111 total entanglement deaths and 45 total vessel collision deaths during 2016–2020 (Table 2). These estimates may be biased if there is significant bias in the detection of entanglement versus vessel collision serious injuries. From 1990 to 2017, NMFS determined a total of 62 right whales were seriously injured, and of these 54 (87%) were due to entanglement. However, during the same period, of 41 right whale carcasses examined for cause of death, 21 (51%) were attributed to vessel collision and 20 (49%) to entanglement. Moore *et al.* (2004) and Sharp *et al.* (2019) theorized that the underrepresentation of entanglement deaths in examined carcasses may be the result of weight loss in chronically entangled whales, who can become negatively buoyant and sink at the time of death, whereas whales killed instantly by vessel collision may remain available for detection for a longer period and are more likely to be recovered for examination. However, floating carcasses of whales will only drift with wind and currents, and may not be carried into areas where detection is likely, whereas entangled whales may continue to swim for months and move into areas patrolled by survey teams. An initial review of the serious injury and mortality records maintained by the NMFS Greater Atlantic and Southeast Regional Offices between 2001–2020 found that 59% of all right whale serious injuries were first documented by survey teams, but only 19% of right whale carcasses were first discovered by survey teams. The visibility of some entanglements can also add to the likelihood of detection, whereas blunt trauma from a vessel collision is not externally detectable. Both Pace *et al*. (2021) and Moore *et al*. (2020) recommend continued research into the potential mechanisms creating the disparity between apparent causes of serious injuries and necropsy results.

Table 2. Annual estimated and observed human-caused mortality and serious injury for the North Atlantic right whale (Eubalaena glacialis). Observed values are from confirmed interactions from 2016–2020. Estimated total mortality is derived from annual population estimates from 2015–2019 (Pace et al. 2017; Pace et al. 2021).

Years	Source	Total	Annual Average
2016–2020	Observed total human-caused M/SI[a]	40.5	8.1
	Observed incidental fishery-related M/SI[a,b]	28.5	5.7
	Observed vessel collision M/SI1	12	2.4
	Fishery-related SI prevented[c]	6	1.2

a. Observed serious injury events with decimal values were counted as 1 for this comparison.
b. The observed incidental fishery interaction count does not include fishery-related serious injuries that were prevented by disentanglement.
c. Fishery-related serious injuries prevented are a result of successful disentanglement efforts.

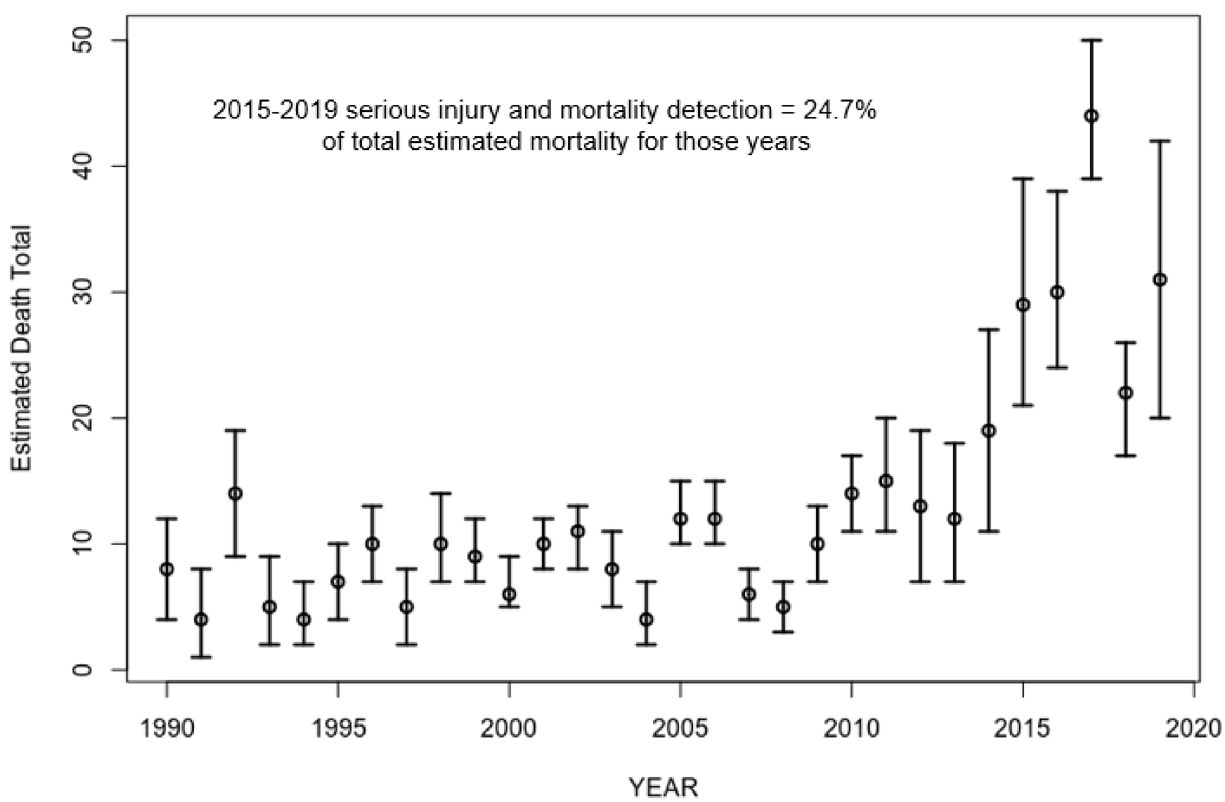

Figure 6. Time series of estimated total right whale mortalities, 1990–2019.

The small population size and low annual reproductive rate of right whales suggest that human sources of mortality have a greater effect relative to population growth rates than for other whale species (Corkeron *et al.* 2018). The principal factors preventing growth and recovery of the population are entanglement and vessel strikes. Between 1970 and 2018, 124 right whale mortalities were recorded (Knowlton and Kraus 2001; Moore *et al.* 2005; Sharp *et al.* 2019). Of these, 18 (14.5%) were neonates that were believed to have died from perinatal complications or other natural causes. Of the remainder, 26 (21.0%) resulted from vessel strikes, 26 (21.0%) were related to entanglement in fishing gear, and 54 (43.5%) were of unknown cause. At a minimum, therefore, 42% of the observed total for the period and 43% of the 102 non-calf deaths were attributable to human impacts (calves accounted for six deaths from vessel strikes and two from entanglements). However, when considering only those cases where cause of death could be determined, 100% of non-calf mortality was human-caused. Hayes *et al*. (2018) reported an increasing trend in entanglement mortality and serious injuries during 2000-2017,while vessel strikes had no specific trend despite several reported cases in 2017. Detected vessel strike mortalities were again relatively numerous in 2019, and in 2020 one calf was seriously injured and another killed by vessel strikes in US waters (Table 3).

The details of a particular mortality or serious injury record often require a degree of interpretation (Moore *et al.* 2005; Sharp *et al.* 2019). The cause of death is based on analysis of the available data; additional information may result in revisions. When reviewing Table 3 below, several factors should be considered: 1) a vessel strike or entanglement may have occurred at some distance from the location where the animal is detected/reported; 2) the mortality or injury may involve multiple factors; for example, whales that have been both vessel struck and entangled are not uncommon; 3) the actual vessel or gear type/source is often uncertain; and 4) entanglements may involve several types of gear. Beginning with the 2001 Stock Assessment Report, Canadian records have been incorporated into the mortality and serious injury rates to reflect the effective range of this stock. However, because whales have been known to carry gear for long periods of time and over great distances before being detected, and recovered gear is often not adequately marked, it can be difficult to assign some entanglements to the country of origin.

It should be noted that entanglement and vessel collisions may not seriously injure or kill an animal directly, but may weaken or otherwise affect a whale's reproductive success (van der Hoop *et al.* 2017; Corkeron *et al.* 2018; Christiansen *et al*. 2020; Stewart *et al*. 2021). The NMFS serious injury determinations for large whales commonly include animals carrying gear when these entanglements are constricting or are determined to interfere with foraging (Henry *et al*. 2022). Successful disentanglement and subsequent resightings of these individuals in apparent good health are criteria for downgrading an injury to non-serious. However, these and other non-serious injury determinations should be considered to fully understand anthropogenic impacts to the population, especially in cases where females' fecundity may be affected.

Fishery-Related Mortality and Serious Injury

Not all mortalities are detected, but reports of known mortality and serious injury relative to PBR, as well as total human impacts, are contained in the records maintained by the New England Aquarium and the NMFS Greater Atlantic and Southeast Regional Offices. Records were reviewed and those determined to be human-caused are detailed in Table 3. Information from an entanglement event often does not include the detail necessary to assign the entanglements to a particular fishery or location.

Although disentanglement is often unsuccessful or not possible for many cases, there are several documented cases of entanglements for which the intervention by disentanglement teams averted a likely serious-injury determination. See Table 2 for the annual average of serious injuries prevented by disentanglement.

Whales often free themselves of gear following an entanglement event, and as such scarring may be a better indicator of fisheries interaction rates than entanglement records. Scarring rates suggest that entanglements occur at about an order of magnitude more often than detected from observations of whales with gear on them. Knowlton et al. (2012) reviewed scarring on identified individual right whales over a period of 30 years (1980–2009), documenting 1,032 definite, unique entanglement events on the 626 individual whales(). Most individual whales (83%) were entangled at least once, and over half of them (59%) were entangled more than once. About a quarter of the individuals identified in each year (26%) were entangled in that year. Juveniles and calves were entangled at higher rates than were adults. Moore *et al.* (2021) reported that between 1980 and 2017, 86.1% (642 of 746) individual whales identified had evidence of entanglement interactions. Analysis of whales carrying entangling gear also suggest that entanglement wounds have become more severe since 1990, possibly due to increased use of stronger lines in fixed fishing gear (Knowlton *et al*. 2016).

Knowlton *et al.* (2012) concluded from their analysis of entanglement scarring rates from 1980–2009 that efforts of the prior decade to reduce right whale entanglement had not worked. Using a completely different data source (observed mortalities of eight large whale species, 1970–2009), van der Hoop *et al*. (2012) arrived at a similar conclusion. Similarly, Pace *et al.* (2015), analyzing entanglement rates and serious injuries due to entanglement during 1999–2009, found no support that mitigation measures implemented prior to 2009 had been effective at reducing takes due to commercial fishing. Since 2009, new entanglement mitigation measures (72 FR 193, 05 October 2007; 79 FR 124, 27 June 2014) have been implemented as part of the Atlantic Large Whale Take Reduction Plan, but their effectiveness has yet to be evaluated. One difficulty in assessing mitigation measures is the need for a statistically significant time series to determine effectiveness.

Other Mortality

Vessel strikes are a major cause of mortality and injury to right whales (Kraus 1990; Knowlton and Kraus 2001, van der Hoop *et al.* 2012). Records from 2016 through 2020 have been summarized in Table 3. Early analyses of the effectiveness of the vessel-strike rule were reported by Silber and Bettridge (2012). van der Hoop *et al.* (2015) concluded that large whale mortalities due to vessel strikes appeared to have decreased inside active seasonal management areas (SMAs) but increased outside inactive SMAs. They suggested increasing spatial coverage to improve the Rule's effectiveness. Analysis by Laist *et al.* (2014) incorporated an adjustment for drift around areas regulated under the vessel-strike rule and produced weak evidence that the rule was effective inside the SMAs. Hayes et al. (2018) found there was no apparent trend up or down in ship strike serious injury and mortality between 2000 and 2017 when simple logistic regression models fit using maximum likelihood-based estimation procedures were applied to reported vessel strikes. NMFS (2020) found that compliance to the vessel strike rule varied across the right whale's range in US waters. In 2018-2019, ten years after the rule's enactment, compliance in seasonal management areas from Delaware northward exceeded 85%. Morehead City also exceeded 85%, and the Southeast seasonal management area compliance was 84.6%. Lower compliance rates were noted for the Chesapeake (78%) and North Carolina to Georgia (69%) seasonal management areas. Compliance varied considerably by vessel type; fishing vessels showed the highest level of compliant transit (93%) while other cargo and pleasure vessels had low levels of compliance (44% and 31%, respectively). Using simple biophysical models, Kelley *et al*. (2020) determined that whales can be seriously injured or killed by vessels of all sizes, and that collision with a 50-ton fishing vessel transiting at 7 knots has a probability of lethality greater than 50%.

An Unusual Mortality Event was established for North Atlantic right whales in June 2017 due to elevated strandings along the Northwest Atlantic Ocean coast, especially in the Gulf of St. Lawrence region of Canada . There were 33 dead whales documented through December 2020, with 19 whales having evidence of vessel strike or entanglement as the preliminary cause of death. Additionally, 11 free-swimming whales were documented as being seriously injured due to entanglements during the time period. One additional free-swimming whale was seriously injured byvessel strike. Therefore, through December 2020, the number of whales included in the UME was 45, including 33 dead and 12 seriously injured free-swimming whales. UME updates are available at (https://www.fisheries.noaa.gov/national/marine-life-distress/2017-20210-north-atlantic-right-whale-unusual-mortality-event).

Table 3. Confirmed human-caused mortality and serious injury records of right whales: 2016–2020[a]

Date[b]	Fate	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]	Description
01/29/2016	Serious Injury	1968	off Jupiter Inlet, FL	EN	1	XU	NP	No gear present, but evidence of recent entanglement of unknown configuration. Significant health decline: emaciated, heavy cyamid coverage, damaged baleen. Resighted in April 2017 still in poor cond.

05/19/2016	Serious Injury	3791	off Chatham, MA	EN	1	XU	NP	New entanglement injuries on peduncle. Left pectoral appears compromised. No gear seen. Significant health decline: emaciated with heavy cyamid coverage. No resights post Aug 2016.
05/03/2016	Mortality	4681	Morris Island, MA	VS	1	US	-	Fresh carcass with 9 deep ventral lacerations. Multiple shorn and/or fractured vertebral and skull bones. Destabilized thorax. Edema, blood clots, and hemorrhage associated with injuries. Proximate COD - sharp trauma. Ultimate COD - exsanguination.
07/26/2016	Serious Injury	1427	Gulf of St Lawrence, QC	EN	1	XC	NP	No gear present, but new entanglement injuries on peduncle and fluke insertions. No gear present. Resights show subsequent health decline: gray skin, rake marks, cyamids.
08/1/2016	Serious Injury	3323	Bay of Fundy, NS	EN	1	XC	NP	No gear present, but new, severe entanglement injuries on peduncle, fluke insertions, and leading edges of flukes. Significant health decline: emaciated, cyamids patches, peeling skin. No resights.
08/13/2016	Serious Injury	4057	Bay of Fundy, NS	EN	1	CN	PT	Free-swimming with extensive entanglement. Two heavy lines through mouth, multiple loose body wraps, multiple constricting wraps on both pectorals with lines across the chest, jumble of gear by left shoulder. Partially disentangled: left with line through mouth and loose wraps at right flipper that are expected to shed. Significant health decline: extensive cyamid coverage. Current entanglement appears to have exacerbated injuries from previous entanglement (see 16Feb2014 event). No resights.
08/16/2016	Prorated Injury	1152	off Baccaro, NS	EN	0.75	XC	NR	Free-swimming with line and buoy trailing from unknown attachment point(s). No resights.
08/28/2016	Serious Injury	2608	off Brier Island, NS	EN	1	XC	NR	Free-swimming with constricting wraps around rostrum and right pectoral. Line trails 50 ft aft of flukes. Significant health decline: heavy cyamid coverage and indication of fluke deformity. No resights.
08/31/2016	Mortality	4320	Sable Island, NS	EN	1	CN	PT	Decomposed carcass with multiple constricting wraps on pectoral with associated bone damage consistent with chronic entanglement.

09/23/2016	Mortality	3694	off Seguin Island, MA	EN	1	CN	PT	Fresh, floating carcass with extensive, constricting entanglement. Thin blubber layer and other findings consistent with prolonged stress due to chronic entanglement. Gear previously reported as unknown.
12/04/2016	Prorated Injury	3405	off Sandy Hook, NJ	EN	0.75	XU	NE	Lactating female. Free-swimming with netting crossing over blowholes and one line over back. Full configuration unknown. Calf not present, possibly already weaned. No resights. Gear type previously reported as NR.
04/13/2017	Mortality	4694	Cape Cod Bay, MA	VS	1	US	-	Carcass with deep hemorrhaging and muscle tearing consistent with blunt force trauma.
06/19/2017	Mortality	1402	Gulf of St Lawrence, QC	VS	1	CN	-	Carcass with acute internal hemorrhaging consistent with blunt force trauma.
06/21/2017	Mortality	3603	Gulf of St Lawrence, QC	EN	1	CN	PT	Fresh carcass found anchored in at least 2 sets of gear. Multiple lines through mouth and constricting wraps on left pectoral. Glucorticoid levels support acute entanglement as COD.
06/23/2017	Mortality	1207	Gulf of St Lawrence, QC	VS	1	CN	-	Carcass with acute internal hemorrhaging consistent with blunt force trauma.
07/04/2017	Serious Injury	3139	off Nantucket, MA	EN	1	XU	NP	No gear present, but evidence of recent extensive, constricting entanglement and health decline. No resights.
07/06/2017	Mortality	-	Gulf of St Lawrence, QC	VS	1	CN	-	Carcass with fractured skull and associated hemorrhaging. Glucorticoid levels support acute blunt force trauma as COD.
07/19/2017	Serious Injury	4094	Gulf of St Lawrence, QC	EN	1	CN	PT	Line exiting right mouth, crossing over back, ending at buoys aft of flukes. Non-constricting configuration, but evidence of significant health decline. No resights.
07/19/2017	Mortality	2140	Gulf of St Lawrence, QC	VS	1	CN	-	Fresh carcass with acute internal hemorrhaging. Glucorticoid levels support acute blunt force trauma as COD.
08/06/2017	Mortality	-	Martha's Vineyard, MA	EN	1	XU	NP	No gear present, but evidence of constricting wraps around both pectorals and flukes with associated tissue reaction. Histopathology results support entanglement as COD.
09/15/2017	Mortality	4504	Gulf of St Lawrence, QC	EN	1	CN	PT	Anchored in gear with extensive constricting wraps with associated hemorrhaging.

10/23/2017	Mortality	-	Nashawena Island, MA	EN	1	XU	NP	No gear present, but evidence of extensive ent involving pectorals, mouth, and body. Hemorrhaging associated with body and right pectoral injuries. Histo results support entanglement as COD.
01/22/2018	Mortality	3893	55 nm E of Virginia Beach, VA	EN	1	CN	PT	Extensive, severe constricting entanglement including partial amputation of right pectoral accompanied by severe proliferative bone growth. COD - chronic entanglement.
02/15/2018	Serious Injury	3296	33 nm E of Jekyll Island, GA	EN	1	XU	NP	No gear present, but extensive recent injuries consistent with constricting gear on right flipper, peduncle, and leading fluke edges. Large portion of right lip missing. Extremely poor condition - emaciated with heavy cyamid load. No resights.
07/13/2018	Prorated Injury	3312	25.6 nm E of Miscou Island, NB	EN	0.75	CN	NR	Free swimming with line through mouth and trailing both sides. Full configuration unknown - unable to confirm extent of flipper involvement. No resights.
07/30/2018	Prorated Injury	3843	13 nm E of Grand Manan, NB	EN	0.75	XC	GU	Free-swimming with buoy trailing 70 ft behind whale. Attachment point(s) unknown. Severe, deep, raw injuries on peduncle & head. Partial disentanglement. Resighted with line exiting left mouth and no trailing gear. Possible rostrum and left pectoral wraps, but unable to confirm. Improved health, but final configuration unclear. No additional resights.
08/25/2018	Mortality	4505	Martha's Vineyard, MA	EN	1	XU	NP	No gear present. Evidence of constricting pectoral wraps with associated hemorrhaging. COD - acute entanglement
10/14/2018	Mortality	3515	134 nm E of Nantucket, MA	EN	1	XU	NP	No gear present, but evidence of constricting wraps across ventral surface and at pectorals. COD - acute, severe entanglement.
12/20/2018	Prorated Injury	2310	Nantucket, MA	EN	0.75	XU	NR	Free-swimming with open bridle through mouth. Resight in Apr2019 shows configuration changed, but unable to determine full configuration. Health appears stable.No additional resights
12/1/2018	Serious Injury	3208	South of Nantucket, MA	EN	1	XU	NP	No gear present. Evidence of new, healed, constricting body wrap. Health decline evident - grey, lesions, thin. Previously reported as 24Dec2018

6/4/2019	Mortality	4023	46.4 nm ESE of Perce, QC	VS	1	CN	-	Abrasion, blubber hemorrhage, and muscle contusion caudal to blowholes consistent with pre-mortem vessel strike
6/20/2019	Mortality	1281	27.3 nm E of Magdalen Islands, QC	VS	1	CN	-	Sharp trauma penetrating body cavity consistent with vessel strike. Vessel >65 ft based on laceration dimensions.
6/25/2019	Mortality	1514	20.3 nm E of Miscou Island, QC	VS	1	CN	-	Fractured ear bones, skull hemorrhaging, and jaw contusion consistent with blunt trauma from vessel strike.
6/27/2019	Mortality	3450	37.4 nm E of Perce, QC	VS	1	CN	-	Hemothorax consistent with blunt force trauma.
7/4/2019	Serious Injury	3125	35.2 nm E of Perce, QC	EN	1	CN	PT	Free-swimming with extensive entanglement involving embedded head wraps, flipper wraps, and trailing gear. Baleen damaged and protruding from mouth. Partially disentangled: 200-300 ft of line removed. Embedded rostrum and blowhole wraps remain, but now able to open mouth. Significant health decline. No resights.
8/6/2019	Mortality	1226	36.4 nm NW of Iles de la Madeleine, NS	EN	1	CN	NR	Constricting rostrum wraps, in anchored or weighted gear. Carcass found with no gear present but evidence of extensive constricting entanglement involving rostrum, gape, both flippers. COD - probable acute entanglement
1/8/2020	Serious Injury	2020 Calf of 2360	7 nm E of Altamaha Sound, GA	VS	1	US	-	Dependent calf with deep lacerations to head and lips, exposing bone. No resights post 15Jan2020.
2/24/2020	Serious Injury	3180	38.2 nm SE of Nantucket, MA	EN	1	XU	NR	Free-swimming with bullet buoy lodged in right mouthline, far forward. Line seen exiting left gape. No trailing gear visible. Poor condition - emaciated with heavy cyamid load. No resights.
3/16/2020	Prorated Injury	-	Georges Bank	EN	0.75	XU	NR	Free-swimming with 2 polyballs trailing approximately 30 ft aft of flukes. Attachment point(s) and full configuration unknown. No resights
6/24/2020	Mortality	5060	0.5 nm off Elberon, NJ	VS	1	US	-	Dependent calf with deep lacerations along head and peduncle from 2 separate vessel strikes. Head lacerations were chronic and debilitating while the laceration to peduncle was acutely fatal. Proximate COD - sharp and blunt vessel trauma. Ultimate COD - hemorrhage and paralysis.
10/11/2020	Serious Injury	4680	2.7 nm E of Sea Bright, NJ	EN	1	XU	NR	Free-swimming with 2 lines embedded in rostrum, remaining configuration unknown. Extremely poor condition - emaciated with greying skin. Large, open lesion on left side of head. No resights.

10/19/2020	Mortality	3920	10.1 nm S of Nantucket, MA	EN	1	CN	PT	Free-swimming with deeply embedded rostrum wrap. Partial disentanglement - removed 100 ft of trailing line and attached telemetry. Health deteriorated over subsequent sightings - emaciation, increased cyamid load, sloughing skin. Carcass documented on 27Feb2021 off Florida. No necropsy conducted but COD from chronic entanglement most parsimonious.

Assigned Cause	**Five-year mean (US/CN/XU/XC)**
Vessel strike	2.4 (0.8/1.6/0/0)
Entanglement	5.7 (0/2.15/2.65/0.9)

a. For more details on events please see Henry *et al.* 2022.
b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.
c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012).
d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US.
e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir.

HABITAT ISSUES

Baumgartner *et al.* (2017) discussed that ongoing and future environmental and ecosystem changes may displace *C. finmarchicus*, or disrupt the mechanisms that create very dense copepod patches upon which right whales depend. One of the consequences of this may be a shift of right whales into different areas with additional anthropogenic impacts to the species. Record *et al.* (2019) described the effects of a changing oceanographic climatology in the Gulf of Maine on the distribution of right whales and their prey. The warming conditions in the Gulf have altered the availability of late stage *C. finmarchicus* to right whales, resulting in a sharp decline in sightings in the Bay of Fundy and Great South Channel over the last decade (Record *et al.* 2019; Davies *et al.* 2019; Meyer-Gutbrod *et al.* 2021), and an increase in sightings in Cape Cod Bay (Ganley *et al.* 2019). Gavrilchuk *et al.* (2021) suggested that ocean warming in the Gulf of St. Lawrence may eventually compromise the suitability of this foraging area for right whales, potentially displacing them further to the shelf waters east of Newfoundland and Labrador in search of dense *Calanus* patches.

In addition, construction noise and vessel traffic from extensive development of offshore wind along the east coast of the US could result in communication masking, behavioral disruption of foraging and socializing (leading to increased energetic expenditure),increased risk of vessel strike, or avoidance of wind energy areas. Operational noise may be above the behavioral harassment threshold identified by NOAA for continuous noise across entire wind energy areas (Stöber and Thomsen 2021). Offshore wind turbines could also influence the hydrodynamics of seasonal stratification and ocean mixing, which, in turn, could influence shelf-wide primary production and copepod distribution (Broström 2008; Paskyabi and Fer 2012; Paskyabi 2015, Carpenter *et al.* 2016, Afsharian *et al.* 2020). Floating wind turbines may introduce additional hazards for whales, including entanglement in fishing gear or other marine debris caught on turbine mooring lines (Maxwell et al. 2022).

STATUS OF STOCK

This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and also because the North Atlantic right whale is listed as an endangered species under the ESA.The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ and has been declining since 2011 (see Pace *et al.* 2017). The North Atlantic right whale is considered one of the most critically endangered populations of large whales in the world (Clapham *et al.* 1999; NMFS 2017; IUCN 2020). The observed (and clearly biased low) human-caused mortality and serious injury was 8.1 right whales per year from 2016 through 2020. Using the refined methods of Pace *et al.* (2021), the estimated annual rate of total mortality for the period 2015–2019 was 31.2, which is 4.1 times larger than the 7.7 total derived from reported mortality and serious injury for the same period. Given that PBR has been calculated as 0.7, human-caused mortality or serious injury for this stock must be considered significant.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern South Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters. Photo-identification (photo-ID) studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Sloan 2006; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

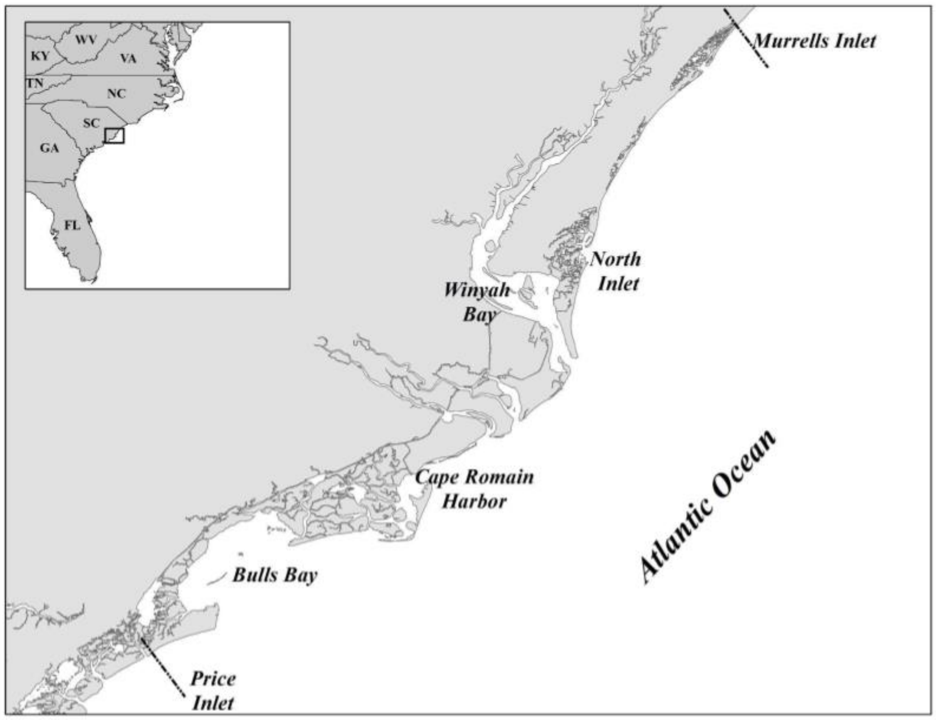

Figure 1. ***Geographic extent of the Northern South Carolina Estuarine System (NSCES) Stock. Dashed lines denote the boundaries.***

Estuarine waters of central South Carolina are characterized by tidal salt marsh around Bulls Bay and the Cape Romain National Wildlife Refuge, and inlets leading to smaller marsh systems, such as at Murrells Inlet. This region has minimal industrial development. Much of the habitat is a shallow, meso-tidal (2–4 m tidal range) estuary consisting of deep channels, creeks, bays and inlets with tidal mud flats and oyster reefs navigable only at high tide (Petricig 1995; Dame *et al.* 2000; Young and Phillips 2002; Sloan 2006).

Sloan (2006) analyzed photo-ID data collected during April–September 2002, July–August 2003 and September 2003 through August 2005 in the Cape Romain National Wildlife Refuge. In total, 1,900 common bottlenose dolphins were recorded during 445 sightings, with 121 individuals identified. Only 36% of individuals had dorsal fins that were considered identifiable. Of the 121 individuals, twenty-two (18%) year-round residents (sighted 4–20 times and in all four water temperature classes: <13°C (cool), 13–19°C (cool transitional), 20–27°C (warm transitional) and >27°C (warm)), 49 (40%) seasonal residents (sighted in 1–3 temperature classes over multiple years or three temperature classes in the same year), and 50 (41%) transients were identified. Sloan (2006) noted that three of the 49 seasonal residents were sighted 10–19 times each, and may be residents missed during months with less survey effort. All year-round residents were sighted exclusively within the salt marsh and never in the coastal waters. Twelve year-round residents showed long-term site-fidelity, with 10 individuals sighted over three years and two individuals sighted over four years. Seasonal shifts in abundance were seen and were attributed to shifts in abundance and behavior of prey species (Sloan 2006).

More recently, Brusa *et al.* (2016) conducted photo-ID surveys in Winyah Bay and North Inlet, South Carolina, to examine distribution and home ranges of common bottlenose dolphins. During May 2011–February 2012, Brusa *et al.* (2016) identified 84 dolphins sighted three or more times on non-consecutive days, with 71 of those sighted during the warm season (May–October), two during the cold season (December–February), and 11 during warm and cold seasons. Similar to Cape Romain, dolphins were present in warm and cold seasons, but found to be less abundant during the cold season. During the warm season, three dolphins were sighted in North Inlet only, 38 dolphins in Winyah Bay only, and 41 dolphins were sighted in both North Inlet and Winyah Bay.

Six dolphins identified in the Cape Romain area were matched via the mid-Atlantic Bottlenose Dolphin Catalog (Urian *et al.* 1999) to animals seen in estuarine waters of Winyah Bay and/or North Inlet, one of which had an extensive year-round sighting history in these northern estuarine waters (Sloan 2006). One dolphin seen in the Cape Romain area was also sighted in Murrells Inlet, South Carolina, north of North Inlet (Sloan 2006). However, this animal was sighted only once and so it is difficult to know whether it was an estuarine animal or simply a coastal dolphin that explored these two areas.

Given the results of these photo-ID studies, the Northern South Carolina Estuarine System (NSCES) Stock is delimited as dolphins inhabiting estuarine waters from Murrells Inlet, South Carolina, southwest to Price Inlet, South Carolina, the northern boundary of the Charleston Estuarine System Stock (Figure 1). Dolphins may be present as far inland as the Intracoastal Waterway and the stock boundary also includes coastal waters up to 1 km offshore. Murrells Inlet is a small estuarine area and likely does not support its own stock of common bottlenose dolphins, but could be utilized by estuarine dolphins from further south. As a result, the stock boundaries for the NSCES Stock include the North Inlet estuary north to Murrells Inlet. North of Murrells Inlet, South Carolina, there is a long stretch of sandy beach with few inlets and no significant estuarine waters. However, these boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of South Carolina. There are insufficient data to determine whether multiple demographically-independent stocks exist within the NSCES area as there have been no directed studies to address this question.

POPULATION SIZE

The best available abundance estimate for the NSCES Stock of common bottlenose dolphins is 453 (95% CI:265–773; CV=0.28; Table 1), based on an August–October 2016 vessel-based capture-recapture photo-ID survey (Silva *et al.* 2019).

Recent surveys and abundance estimates

Silva *et al.* (2019) conducted vessel-based capture-recapture photo-ID surveys during 11 August to 2 October 2016 to estimate abundance of common bottlenose dolphins of the NSCES Stock. One “mark” and two “recapture” sessions were conducted encompassing 245 km of trackline within small bays, salt marsh creeks, and portions of the Intracoastal Waterway. Coastal waters were not surveyed. Surveys extended from North Inlet/Winyah Bay to Dewees Inlet but abundance was estimated only within the current stock boundary to Price Inlet. Data were analyzed with the package Rcapture in Program R, and the bias corrected Chao Mth model was the best fit. Abundance of marked individuals within the stock area was estimated to be 163 dolphins (95% CI:110–282), and this estimate was divided by the proportion of marked individuals (0.36) to estimate total abundance. Therefore, the best estimate for the NSCES Stock was 453 (95% CI:265–773; CV=0.28; Table 1).

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate for the NSCES Stock is 453 (CV=0.28). The resulting minimum population estimate is 359 (Table 1).

Current Population Trend

There are insufficient data to determine the population trends for this stock because only one estimate of population size is available for the entire stock area.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the NSCES Stock is 359. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for this stock of common bottlenose dolphins is 3.6 (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the NSCES Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
453	0.28	359	0.5	0.04	3.6

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the NSCES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.3. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 0.2 (vessel strike by a research vessel). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.5 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

There are two commercial fisheries that interact, or that potentially could interact, with this stock. These include the Category II Southeast Atlantic inshore gillnet fishery and the Atlantic blue crab trap/pot fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Gillnet

During 2016–2020, there were no documented mortalities or serious injuries of common bottlenose dolphins involving gillnet gear. The most recent documented interaction with this fishery was a mortality that occurred in 2011. It should be noted that there is no observer program for this fishery, so it is not possible to estimate the total number of interactions or mortalities associated with gillnets.

Trap/Pot

During 2016–2020 there were two documented entanglement interactions of common bottlenose dolphins in the NSCES Stock area with commercial blue crab trap/pot gear. During 2016 there was one live animal disentangled from commercial blue crab trap/pot gear and released alive, and it was considered seriously injured post-mitigation (Maze-Foley and Garrison 2022). During 2018 there was another live animal entangled in commercial blue crab trap/pot gear, and it could not be determined (CBD) whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). The serious injury and CBD for serious injury (the CBD case was prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and were also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Other Mortality

There was one additional documented serious injury for this stock. In 2017 a common bottlenose dolphin was struck by a research vessel and was considered seriously injured (Maze-Foley and Garrison 2022). All mortalities and serious injuries from known sources for the NSCES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Northern South Carolina Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury Based on Observer Data	5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data
Gillnet	2016–2020	Stranding Data and At-Sea Observations	NA	0
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1.5*[a]
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.3**	
Mean Annual Mortality due to other takes (2016–2020) (vessel strike by a research vessel)			**0.2**	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**0.5**	

a. Includes one non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5) serious injuries based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022).

Strandings

During 2016–2020 seven common bottlenose dolphins were reported stranded within the NSCES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for two of the strandings. No evidence of human interaction was detected for three strandings, and for the remaining two strandings, it could not be determined if there was evidence of human interaction. Human interactions were from entanglements with commercial blue crab trap/pot gear as described above, and there was also a self-reported vessel strike by a research vessel for one animal. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The NSCES Stock has been affected by two unusual mortality events (UMEs) during the past 15 years. A UME was declared in South Carolina during February–May 2011. One stranding assigned to the NSCES Stock was considered to be part of the UME. The cause of this UME was undetermined. An additional UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al*. 2015).

Table 3. Common bottlenose dolphin strandings occurring in the Northern South Carolina Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Northern South Carolina Estuarine System Stock	Total Stranded	2	2	3	0	0	7
	HI--Yes	1a	0	1b	0	0	2
	HI--No	1	2	0	0	0	3
	HI--CBD	0	0	2	0	0	2

a. Includes 1 fishery interaction (FI), an entanglement interaction with commercial blue crab trap/pot gear (released alive seriously injured)
b. Includes 1 FI, an entanglement interaction with commercial blue crab trap/pot gear (released alive, CBD if seriously injured)

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act, and this stock is not a strategic stock under the MMPA. The documented mean annual human-caused mortality for the NSCES stock for 2016–2020 was 0.5. However, it is likely the estimate of annual human-caused, including fishery-caused, mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of tidal salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=3.1), it does not exceed the PBR for this stock based on a minimum abundance of 359. Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Charleston Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, around the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification(photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002a; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

The estuarine habitat within and around the Charleston, South Carolina, area comprises both developed and undeveloped areas. The Ashley, Cooper, and Wando Rivers and the Charleston Harbor are characterized by a high degree of land development and urban areas whereas the Stono River Estuary and North Edisto River have a much lower degree of development. The Charleston Harbor area includes a broad open-water habitat, while the other areas consist of river channels and tidal creeks. The Intracoastal Waterway (ICW) consists of miles of undeveloped salt marshes interspersed with developed suburban areas, and it has the least amount of open water habitat.

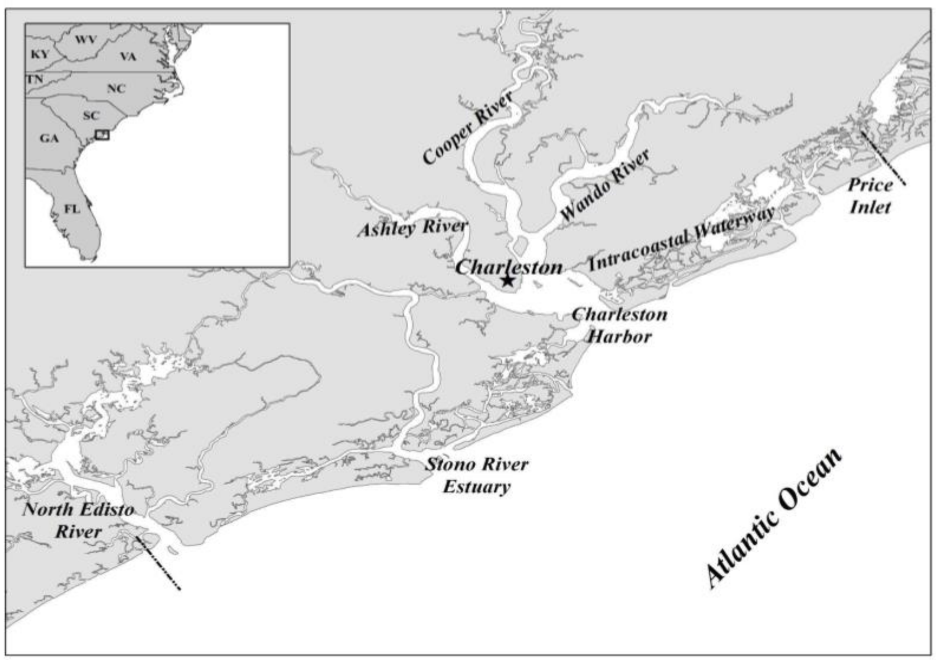

Figure 1. ***Geographic extent of the Charleston Estuarine System (CES) stock. Dashed lines denote the boundaries.***

Zolman (2002) analyzed photo-ID data collected in the Stono River Estuary from October 1994 through January 1996 and identified a number of year-round resident dolphins using this area. Zolman (2002) indicated little likelihood that the Stono River Estuary included the entire home range of a dolphin, as individual resident dolphins were observed in other areas, including the North Edisto River and Charleston Harbor.

Satellite telemetry of two female dolphins captured in the Stono River Estuary in October 1999 supported the photo-ID findings of Zolman (2002) and illustrated the limited range of these dolphins between adjacent estuarine areas and the connective nature of the areas within the Charleston region (Speakman *et al.* 2006). Over 30 additional dolphins have been fitted with VHF tags as a part of capture-release health assessments in 1999 (7 dolphins), 2003 (12 dolphins), and 2005 (16 dolphins). Dolphins were captured in the Stono River Estuary, Charleston Harbor, and the Ashley and Wando Rivers. Tagged dolphins were readily relocated within the confines of the Charleston estuarine system and were regularly tracked up to 93 days post-release (Speakman *et al.* 2006), underscoring the resident nature of dolphins in this region. Finally, three adult males resident to the Stono River Estuary and Charleston Harbor areas (based on long-term sighting histories) were fitted with satellite transmitters within the Stono River Estuary in 2013, and telemetry results demonstrated use of nearshore coastal waters by these residents (Balmer *et al.* 2021).

Speakman *et al.* (2006) summarized photo-ID studies carried out from 1994 to 2003 on common bottlenose dolphins throughout the Charleston Estuarine System. Individual identifications were made for 839 dolphins, with 115 (14%) sighted between 11 and 40 times. Eighty-one percent (81%) of the 115 individuals were sighted over a period exceeding five years while 44% were sighted over a period of 7.7–9.8 years, suggesting long-term residency for some of the dolphins in this area. Using adjusted sighting proportions to correct for unequal survey effort, 42% of the dolphins showed a strong fidelity for a particular area within the CES and 97% of the dolphins had high sighting frequencies in at least two areas, supporting the inclusion of the entire area as a single stock (Speakman *et al.* 2006). Charleston Harbor was identified as a high-use area for this stock (Speakman *et al.* 2006). Also, findings from photo-ID studies indicated that resident dolphins in this stock may use the coastal waters to move between areas, but that resident estuarine animals are distinct from animals that reside in coastal waters or use coastal waters during seasonal migrations (Speakman *et al.* 2006).

Laska *et al.* (2011) investigated movements of dolphins between estuarine and coastal waters in the Charleston estuarine system area by conducting boat-based, photo-ID surveys along 33 km of nearshore coastal waters adjacent to the Stono River Estuary and Charleston Harbor during 2003–2006. Sighting locations as well as all historical (1994–2002) sighting locations were used to classify individuals into a coastal (60% or more of sightings in coastal waters) or estuarine (60% or more of sightings in estuarine waters) community. Most dolphins (68%) identified during the study were classified as coastal, 22% were classified as estuarine, and the remaining 10% showed no preference. Most (69%) sightings along the coast were mixed groups of estuarine and coastal dolphins. This study demonstrated that the resident animals utilize nearshore coastal waters as well as estuarine waters, and that estuarine and coastal dolphins frequently interact in this area (Laska *et al.* 2011).

The Charleston Estuarine System (CES) Stock is bounded to the north by Price Inlet and includes a stretch of the ICW approximately 13 km east-northeast of Charleston Harbor (Figure 1). It continues through Charleston Harbor and includes the main channels and creeks of the Ashley, Cooper, and Wando Rivers. The CES Stock also includes all estuarine waters from the Stono River Estuary, approximately 20 km south-southwest of Charleston Harbor, to the North Edisto River another 20 km to the west-southwest, and all estuarine waters and tributaries of these rivers. Finally, the CES Stock also includes 1 km of nearshore coastal waters from Price Inlet to the North Edisto River (Figure 1). The southern boundary abuts the northern boundary of the Northern Georgia/Southern South Carolina Estuarine System Stock, previously defined based on a photo-ID project (Gubbins 2002a,b,c). The boundaries of the CES Stock are defined based on long-term photo-ID studies and telemetry work (Speakman *et al.* 2006; Adams *et al.* 2008; Laska *et al.* 2011). The CES Stock boundaries are subject to change upon further study of dolphin residence patterns in estuarine waters of North Carolina, South Carolina and Georgia. There are insufficient data to determine whether multiple demographically-independent stocks exist within the CES area as there have been no directed studies to address this question; however, photo-ID data indicate movement of individual dolphins throughout the region (Speakman *et al.* 2006).

POPULATION SIZE

The total number of common bottlenose dolphins residing within the CES Stock is unknown because previous estimates are more than 8 years old (Table 1; NMFS 2016).

Earlier abundance estimates (>8 years old)

Speakman *et al.* (2010) conducted seasonal (January, April, July, October), photo-ID, mark-recapture surveys during 2004–2006 in the estuarine and coastal waters near Charleston including the Stono River Estuary, Charleston Harbor, and the Ashley, Cooper, and Wando Rivers. Pollock's robust design model was applied to the mark-recapture data to estimate abundance. Estimates were adjusted to include the 'unmarked' as well as 'marked' portion of the population for each season. Winter estimates provided the best estimate of the resident estuarine population as transient animals are not thought to be present during winter. The average abundance from January 2005 and January 2006 was 289 (CV=0.03). It is important to note this estimate did not cover the entire range of the CES Stock, and therefore the abundance estimate was negatively biased.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the CES Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the CES Stock of common bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for the CES Stock of common bottlenose dolphins is undetermined (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Charleston Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Undetermined

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the CES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 1.8. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 0.4 (entanglement in unidentified gear and vessel strike). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 2.2 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are the only data used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016) and not every recovered carcass with evidence of entanglement can be assigned to a fishery, 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

There are two commercial fisheries that interact, or potentially interact, with this stock. These include the Category II Atlantic blue crab trap/pot fishery and the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020, there were 11 documented entanglement interactions of common bottlenose dolphins in the CES Stock area with crab trap/pot gear within the stranding data. For 10 of the 11 cases, the gear was confirmed to be commercial blue crab trap/pot gear, and for the remaining case, the identity of the gear was not confirmed. During 2016, there was one mortality. During 2017, there was one mortality and one animal released alive, and it could not be determined (CBD) whether the live animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). During 2018, there were two mortalities and two animals released alive, and it could not be determined whether the live animals were seriously injured following mitigation efforts (the initial determinations were seriously injured; Maze-Foley and Garrison 2022). During 2019, there was one mortality, one animal released alive considered seriously injured following mitigation efforts, and one animal released alive considered not seriously injured (no mitigation, the animal became disentangled on its own; Maze-Foley and Garrison 2022). During 2020 one animal was released alive (unidentified crab trap/pot gear case), and it could not be determined whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). The five mortalities, one serious injury, and four CBD cases (CBD cases were prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and all 11 cases were documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

In addition to the interactions documented within the stranding data, one live common bottlenose dolphin was observed at sea in 2018 entangled in unidentified trap/pot gear. It could not be determined whether the animal was seriously injured. This animal was included (prorated) in the annual human-caused mortality and serious injury total for this stock (Table 2).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2016–2020 within the CES area, there was one documented interaction of a common bottlenose dolphin with hook and line fishing gear. During 2017, there was one mortality for which monofilament line was found during the necropsy; however, it could not be determined whether the hook and line gear interaction contributed to cause of death. Thus, this case was not included in the annual human-caused mortality and serious injury total for this stock (Table 2), but it was included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2016–2020, within the CES area, there were two common bottlenose dolphins documented with evidence of vessel strikes, and two animals entangled in unidentified gear. During 2017, there was one mortality documented with propeller wounds including deep penetrating wounds. During 2019, an additional animal was documented with propeller wounds but the wounds were believed to be obtained post-mortem. During 2018, an animal was entangled in rope but disentangled itself and was considered not seriously injured (Maze-Foley and Garrison 2022). Also in 2018, an animal was entangled in unidentified buoy line (either a crab pot buoy or a dredge buoy) and was considered seriously injured (Maze-Foley and Garrison 2022). All four of these interactions were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). The 2017 vessel strike mortality and 2018 unidentified buoy entanglement serious injury were included in the annual human-caused mortality and serious injury total for this stock (Table 2).

All mortalities and serious injuries from known sources for the CES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Charleston Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable.

Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	**Years**	**Data Type**	**Mean Annual Estimated Mortality and Serious Injury Based on Observer Data**	**5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data**
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	7.8*a
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1b
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	0
Mean Annual Mortality due to commercial fisheries (2016–2020)			**1.8**	
Mean Annual Mortality due to other takes (2016–2020) (unid gear entanglement and vessel strike)			**0.4**	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**2.2**	

a. Includes four cases of CBD which were prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There were four cases of non-calf entanglements in which the post-mitigation determinations were CBD. The CBDs were prorated as 0.46 serious injuries for each (1.84 total, rounded to 1.8 serious injuries).

b. One case of CBD which was prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There was one non-calf entanglement in which the initial determination was a CBD (no mitigation), and this case was prorated as a serious injury.

Strandings

During 2016–2020, 101 common bottlenose dolphins were reported stranded within the CES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for 22 of the strandings. No evidence of human interaction was detected for 36 strandings, and for the remaining 43 strandings, it could not be determined if there was evidence of human interaction. Human interactions were from numerous sources, including entanglements with commercial blue crab trap/pot gear, unidentified trap/pot gear, hook and line gear, an unidentified buoy line, marine debris/rope, and there was also evidence of vessel strikes. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

Table 3. Common bottlenose dolphin strandings occurring in the Charleston Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Charleston Estuarine System Stock	Total Stranded	19	19	18	32	13	101
	HI--Yes	3[a]	5[b]	6[c]	6[d]	2[e]	22
	HI--No	9	8	3	13	3	36
	HI--CBD	7	6	9	13	8	43

a. Includes 1 fishery interaction (FI), an entanglement interaction with commercial blue crab trap/pot gear (mortality).

b. Includes 1 mortality with evidence of a vessel strike and 3 FIs, 2 of which were entanglement interactions with commercial blue crab trap/pot gear (1 mortality; 1 released alive, CBD if seriously injured) and 1 was an entanglement interaction with hook and line gear (mortality).

c. Includes 1 entanglement interaction with an unidentified buoy (released alive, seriously injured), 1 entanglement interaction with rope (released alive, not seriously injured), and 4 FIs, consisting of 4 entanglement interactions with commercial blue crab trap/pot gear (2 mortalities; 2 released alive, CBD if seriously injured).

d. Includes 1 mortality with evidence of a vessel strike and 3 FIs, all of which were entanglement interactions with commercial blue crab trap/pot gear (1 mortality; 1 released alive seriously injured; and 1 released alive, not seriously injured).

e. Includes 1 fishery interaction (FI), an entanglement interaction with unidentified trap/pot gear (released alive, CBD if seriously injured).

The CES Stock has been affected by two unusual mortality events (UMEs) during the past 15 years. A UME was declared in South Carolina during February–May 2011. Ten strandings assigned to the CES Stock were considered to be part of the UME. The cause of this UME was undetermined. An additional UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus-positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015).

HABITAT ISSUES

This stock inhabits areas of high human population densities, where a large portion of the stock's range is highly industrialized or agricultural. Charleston Harbor, a busy harbor containing five shipping terminals (Weinpress-Galipeau *et al.* 2021), has been identified as a core area for the stock (Bouchillon *et al.* 2019). Strandings in South Carolina were greater near urban areas and those with agricultural input (McFee and Burdett 2007).

Numerous studies have investigated chemical contaminant concentrations and potential associated health risks for common bottlenose dolphins in the CES. An early study measured blubber concentrations of persistent organic pollutants and found that samples from male dolphins near Charleston exceeded toxic threshold values that could potentially result in adverse effects on health or reproductive rates (Hansen *et al.* 2004; Schwacke *et al.* 2004). In addition, Fair *et al.* (2007) found that mean total polybrominated diphenyl ethers (PBDE) concentrations, associated with sewage sludge and urban runoff, were five times greater in the blubber of Charleston dolphins than levels reported for dolphins in the Indian River Lagoon, and Adams *et al.* (2014) confirmed that PBDE concentrations were higher in CES dolphins that utilized more urbanized/industrialized portions of the area. A broader study by Kucklick *et al.* (2011) demonstrated that, while concentrations of some emerging pollutants such as PBDEs were relatively high for dolphins sampled from the CES area as compared to dolphins sampled from 13 other locations long the U.S. Atlantic and Gulf coasts and Bermuda, concentrations of legacy pollutants with well-established toxic effects such as polychlorinated biphenyls and DDT in CES dolphins were more intermediate as compared to the other coastal locations (Kucklick *et al.* 2011).

Perfluoroalkyl compounds have also been measured from the plasma of common bottlenose dolphins from the CES area (Adams *et al.* 2008). Using blood samples collected from dolphins near Charleston, Adams *et al.* (2008) found dolphins affiliated with areas characterized by high degrees of industrial and urban land use had significantly higher plasma concentrations of perfluoroctane sulfonate, perfluorodecanoic acid and perfluoroundeconic acid (PFUnA) than dolphins which spent most of their time in residential areas with lower developed land use, such as wetland marshes. Dolphins residing predominantly in the Ashley, Cooper, and Wando Rivers exhibited significantly greater mean plasma concentration of PFUnA than those associated with Charleston Harbor.

Morbillivirus is a concern for dolphin stocks, particularly along the U.S. Atlantic coast where the disease has resulted in UMEs. Serum samples from dolphins within the CES area have negative titers of antibodies to both dolphin morbillivirus and porpoise morbillivirus (Rowles *et al.* 2011, Bossart *et al.* 2010), indicating that sampled dolphins have not been exposed to morbillivirus in recent years. Therefore, CES dolphins likely have low levels of protective antibodies and could be vulnerable to infection if the disease were to be introduced into the stock.

During 2003–2013, Bossart *et al.* (2015) examined mucocutaneous lesions in free-ranging common bottlenose dolphins within the CES area and found the presence of orogenital sessile papillomas, nonspecific chronic to chronic-active dermatitis, and epidermal hyperplasia. The study suggested the prevalence of lesions may reflect chronic exposure to anthropogenic and environmental stressors, such as contaminants and infectious or inflammatory disease.

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. While the abundance of the CES Stock is currently unknown, based on previous abundance estimates (Waring *et al*. 2015), it is likely small and therefore relatively few mortalities and serious injuries would exceed PBR. The documented minimum mean annual human-caused mortality for the CES stock for 2016–2020 was 2.2, with an annual average of 1.8 primarily attributed to the blue crab trap/pot and 0.4 from other sources of human mortality (e.g., unknown fishing gear, vessel strikes). However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of river channels, tidal creeks, and salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=13.8), it exceeds the previous PBR for this stock based on a minimum abundance of 281. Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the previously calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Northern Georgia/Southern South Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002a; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

Figure 1. ***Geographic extent of the Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stock. The borders are denoted by dashed lines.***

Estuarine areas in southern South Carolina and northern Georgia are characterized by extensive tidal marshes, shallow lagoonal estuaries, and riverine input (Savannah, Coosawhatchie, Combahee Rivers). Estuarine circulation patterns are dominated mainly by freshwater inflow and tides in South Carolina and Georgia. This region includes the large population centers of Savannah, Georgia, and Hilton Head, South Carolina, which are also areas of significant tourism.

From 1994 to 1998, Gubbins (2002a,b,c) surveyed an area around Hilton Head Island bordered on the north by the May River, on the south by the Calibogue Sound, on the west by Savage Creek and on the east by Hilton Head Island. Broad Creek, which bisects Hilton Head Island, and nearshore ocean waters out to 2 km at the mouth of Calibogue Sound were regularly surveyed. Occasional surveys were made around Hilton Head Island. Gubbins (2002b) categorized each dolphin identified in the Hilton Head area as a year-round resident or a seasonal transient based on overall resighting patterns. Residents were seen in all four seasons whereas transients were seen only in one or two seasons. Resident dolphins were observed from 10 to 116 times, whereas transients were observed fewer than nine times (Gubbins 2002b). Sixty-four percent of the dolphins photographically identified were resighted only once between 1994 and 1998. Both resident and transient dolphins occurred in the waters of Calibogue Sound (Gubbins 2002b,c; Gubbins *et al.* 2003), whereas in the tidal creeks and rivers, primarily small, tight groups of resident dolphins were seen, with only an occasional transient dolphin. Two dolphins were resighted between Hilton Head and Jacksonville, which likely represent transients or seasonal residents (Gubbins 2002b). Gubbins *et al.* (2003) reported dolphin abundance in the Hilton Head area was lowest from February to April, with two peaks in abundance observed in May and July. Some dolphins were sighted for short periods in the summer, indicating transients or seasonal residents may move inshore to this area during the summer months.

Griffin *et al.* (2021) used genetic and photo-ID data to examine fine-scale population structure of common bottlenose dolphins in northern Georgia, from the southern Savannah River channel to northern Ossabaw Sound, which encompassed the southernmost portion of the Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stock and a small portion of the northernmost section of the Central Georgia Estuarine System (CGES) Stock. No significant genetic differentiation was found among three a priori defined regions within the study area when the full sample set was utilized, but after using photo-ID data to identify dolphins with ≥ 10 sightings and assigning them to the region they utilized most, a significant genetic difference was found between the north region and the other two regions. Further work is necessary to evaluate whether multiple demographically independent populations exist within the NGSSCES Stock.

The NGSSCES Stock is bounded to the north by the southern border of the Charleston Estuarine System Stock at the southern extent of the North Edisto River and extends southwestward to the northern extent of Ossabaw Sound. It includes St. Helena, Port Royal, Calibogue and Wassaw Sounds, as well as the estuarine waters of the rivers and creeks and 1 km of nearshore coastal waters that lie within this area (Figure 1). Photo-ID matches of estuarine animals from the NGSSCES region and the estuarine stocks to the north and south have not been made (Urian *et al.* 1999). The borders are based primarily on results of photo-ID studies conducted by Gubbins (2002a,b,c) in this region, and photo-ID and telemetry research carried out north of this region (Zolman 2002; Speakman *et al.* 2006), and are subject to change upon further study of dolphin residency patterns in estuarine waters of South Carolina and Georgia.

POPULATION SIZE

The total number of common bottlenose dolphins residing within the NGSSCES Stock is unknown (Table 1).

Earlier abundance estimates (>8 years old)

Data collected by Gubbins (2002b) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in four estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used. Based on photo-ID data from 1994 to 1998, 234 individually identified dolphins were observed (Gubbins *et al.* 2003), which included 52 year-round residents and an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 234 individually identifiable dolphins and the population size for the Hilton Head area was estimated to be 525 dolphins (CV=0.16; Gubbins *et al.* 2003). This was an overestimate of the resident stock abundance within the study area because it included non-resident and seasonally resident dolphins. In addition, the study area did not encompass the entire area occupied by the NGSSCES Stock and therefore this population size could not be considered a reliable estimate of abundance for this stock.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the NGSSCES Stock of common bottlenose dolphins.

Current Population Trend

No reliable abundance estimate is available for this stock, and therefore there are insufficient data to assess population trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the NGSSCES Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for the NGSSCES Stock of common bottlenose dolphins is unknown (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Northern Georgia/Southern South Carolina Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Unknown

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the NGSSCES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 1.3. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 0.2 (vessel strike). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 1.5 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

There are two commercial fisheries that interact, or potentially interact, with this stock. These include the Category II Atlantic blue crab trap/pot fishery and the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020, there were six documented entanglement interactions of common bottlenose dolphins in the NGSSCES Stock area with crab trap/pot gear. For five of the six cases, the gear was confirmed to be commercial blue crab trap/pot gear, and for the remaining case, the gear was unidentified trap/pot gear. During 2016, there was one mortality, and during 2017, there were two mortalities. During 2018, there was one mortality and one animal released alive, and it could not be determined (CBD) whether the live animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). During 2020, there was one mortality (unidentified gear). The five mortalities and one CBD for serious injury (the CBD case was prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and all six cases were documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2016–2020, within the NGSSCES area, there was one documented interaction within the stranding data of a common bottlenose dolphin entangled in hook and line fishing gear. The interaction occurred during 2020, and the live animal was considered seriously injured (Maze-Foley and Garrison 2022). This serious injury is included in the annual human-caused mortality and serious injury total for this stock (Table 2), and the case was included in the stranding database and in the stranding totals presented in Table 3 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2016–2020 within the NGSSCES area, there was one common bottlenose dolphin released alive in 2016 considered not seriously injured following entanglement in research gillnet gear (bonnethead shark research; Maze-Foley and Garrison 2022), and one documented mortality in 2020 of a common bottlenose dolphin with evidence of a vessel strike (series of propeller wounds). Both of these interactions were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). The 2020 vessel strike mortality was included in the annual human-caused mortality and serious injury total for this stock (Table 2).

All mortalities and serious injuries from known sources for the NGSSCES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Northern Georgia/Southern South Carolina Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	**Years**	**Data Type**	**Mean Annual Estimated Mortality and Serious Injury Based on Observer Data**	**5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data**
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	4.5*a
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2016–2020)			**1.3**	
Mean Annual Mortality due to other takes (2016–2020) (vessel strike)			**0.2**	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**1.5**	

a. Includes one non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5) serious injuries based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022).

Strandings

During 2016–2020, 71 common bottlenose dolphins were reported stranded within the NGSSCES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for 14 of the strandings. No evidence of human interaction was detected for 20 strandings, and for the remaining 37 strandings, it could not be determined if there was evidence of human interaction. Human interactions were from numerous sources, including entanglements with commercial blue crab trap/pot gear, recreational trap/pot gear, hook and line gear, research gillnet gear, and evidence of a vessel strike. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The NGSSCES Stock has been affected by two unusual mortality events (UMEs) during the past 15 years. A UME was declared in South Carolina during February–May 2011. Twelve strandings assigned to the NGSSCES Stock were considered to be part of the UME. The cause of this UME was undetermined. An additional UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015).

Table 3. Common bottlenose dolphin strandings occurring in the Northern Georgia/Southern South Carolina Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Northern Georgia/Southern South Carolina Estuarine System Stock	Total Stranded	18	13	19	7	14	71
	HI--Yes	4a	3b	4c	0	3d	14
	HI--No	5	6	2	1	6	20
	HI--CBD	9	4	13	6	5	37

a. Includes 1 entanglement in research gillnet gear (alive, not seriously injured) and 1 fishery interaction (FI), an entanglement interaction with commercial blue crab trap/pot gear (mortality).

b. Includes 2 FIs, both of which were entanglement interactions with commercial blue crab trap/pot gear (mortalities).

c. Includes 2 FIs, both of which were entanglement interactions with commercial blue crab trap/pot gear (1 mortality; 1 released alive, CBD if seriously injured).

d. Includes 1 mortality with evidence of a vessel strike and 2 FIs, 1 of which was entanglement interaction with hook and line gear (released alive, seriously injured) and the other was an entanglement interaction with recreational trap/pot gear (mortality).

HABITAT ISSUES

This stock inhabits areas with significant drainage from urban and agricultural areas and as such is exposed to contaminants in runoff from those sources. In other estuarine areas where contaminant analyses have been conducted, it has been suggested that exposure to anthropogenic contaminants could potentially result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Analyses of contaminants has been conducted only in the southernmost portion of this stock's range comparing PCB concentrations between dolphins stranded in the Savannah area (Wassaw, Ossabaw and St. Catherine's Sounds) and dolphins using the Turtle/Brunswick River Estuary (TBRE; Pulster and Maruya 2008; Pulster *et al.* 2009). Total PCB concentrations were 10 times higher in dolphins from the TBRE compared to the stranded animals from the Savannah area. The signature of Aroclor 1268, a PCB used in roofing and caulking compounds, was distinct between the TBRE and Savannah area dolphins and closely resembled those of local TBRE prey fish species (Pulster and Maruya 2008; Pulster *et al.* 2009).

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Kovacs and Cox 2014; Perrtree *et al.* 2014; Wu 2013). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the behavior and increase the risk of injury or death to wild dolphins. Dolphins in estuarine waters near Savannah recently showed the highest rate of begging behavior reported from any study site worldwide (Perrtree *et al.* 2014). Another study in the same Savannah study area by Hazelkorn *et al.* (2016) showed behavioral differences between beggar and non-beggar dolphins, and suggested a persistent behavioral shift may be taking place whereby dolphin-human interactions are increasing, which in turn could result in an increase in injuries to the dolphins. There are links between provisioning wild dolphins, dolphin depredation of recreational fishing gear, and associated entanglement and ingestion of gear (Powell and Wells 2011; Christiansen *et al.* 2016; Powell *et al.* 2018).

High boat activity in the Hilton Head area could result in a change in movement patterns, alteration of behavior of both dolphins and their prey, disruption of echolocation and masking of communication, physical damage to ears, collisions with vessels and degradation of habitat quality (Richardson *et al.* 1995; Ketten 1998; Gubbins 2002b; Gubbins *et al.* 2003; Mattson *et al.* 2005). The effect of boat and jet ski activity was investigated by Mattson *et al.* (2005) during the summer of 1998 along Hilton Head Island. Dolphins changed behavior more often when boats were present, and group size was significantly larger in the presence of one boat and was largest when multiple boats were present. Jet skis elicited a strong and immediate reaction with dolphins remaining below the surface for long periods of time. Dolphins always changed behavior and direction of movement in the presence of shrimp boats, while ships and ferries elicited little to no obvious response. The long-term impacts of such repeated harassment and disturbance on survival and reproduction remain to be determined.

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. While the abundance of the NGSSCES Stock is currently unknown, based on the previous abundance estimate (Gubbins *et al.* 2003), it is likely small and therefore relatively few mortalities and serious injuries would exceed PBR. The documented minimum mean annual human-caused mortality for the NGSSCES stock for 2016–2020 was 1.5, with an annual average of 1.3 primarily attributed to the blue crab trap/pot and 0.2 from other sources of human mortality (e.g., vessel strike). However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of tidal salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=9.4), it exceeds the previous PBR based on an older minimum abundance for this stock of 117 (Gubbins *et al.* 2003). Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the previously calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Central Georgia Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

Figure 1. ***Geographic extent of the Central Georgia Estuarine System (CGES) Stock. Dashed lines denote the boundaries.***

Coastal central and northern Georgia contains an extensive estuarine tidal marsh system in which common bottlenose dolphins are documented. The primary river drainages in this region are the Altamaha in central Georgia and the Savannah River at the Georgia-South Carolina border. Much of the coastal marsh and islands in the area has been privately owned since the early 19th century and has therefore experienced little development, and the marshes and coastal region are relatively undisturbed. The Sapelo Island National Estuarine Research Reserve, part of NOAA's Estuarine Reserve System, lies in this section of the Georgia coast and includes 4,000 acres of tidal salt marsh.

The Central Georgia Estuarine System Stock (CGES) is delineated in the estuarine waters of central Georgia (Figure 1). It extends from the northern extent of Ossabaw Sound, where it meets the border with the Northern Georgia/Southern South Carolina Estuarine System Stock, south to the Altamaha River, which provides the border between the CGES and the Southern Georgia Estuarine System Stock. Nearshore (≤ 1 km from shore) coastal waters are also included in the CGES Stock boundaries.

The boundaries of this stock are supported by photo-ID data. Balmer *et al.* (2011) conducted photo-ID studies between 2004 and 2009 in the Turtle/Brunswick River estuary (TBRE) in southern Georgia and in estuarine habitats from Altamaha Sound north to Sapelo Sound. Photo-ID data revealed strong site fidelity to the two regions and supported Altamaha Sound as an appropriate boundary between the two stocks as 85.4% of animals identified did not cross Altamaha Sound (Balmer *et al.* 2013). Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South Carolina/Georgia Coastal Stock. In addition, common bottlenose dolphins sampled within the Sapelo Island area exhibited contaminant burdens significantly lower than those sampled to the south in the TBRE (Balmer *et al.* 2011; Kucklick *et al.* 2011), consistent with long-term fidelity to these separate areas. Analyses to determine whether multiple demographically independent populations exist within this stock have not been performed to date.

POPULATION SIZE

The current total number of common bottlenose dolphins residing within the CGES Stock is unknown because previous estimates are more than 8 years old (Table 1; NMFS 2016).

Earlier abundance estimates (>8 years old)

During 2008–2009, seasonal, mark-recapture photo-ID surveys were conducted to estimate abundance in a portion of the CGES area from Altamaha Sound north to Sapelo Sound. Estimates from winter were chosen as the best representation of the resident estuarine stock in the area surveyed, and a Markovian emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance, based on winter 2008 and winter 2009 surveys, was 192 (CV=0.04; Balmer *et al.* 2013). Estimates were adjusted to include the 'unmarked' (not distinctive) as well as 'marked' (distinctive) portion of the population for each winter survey. It is important to note this estimate covered approximately half of the entire range of the CGES Stock, and therefore, the abundance estimate is negatively biased.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the CGES Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock because only one estimate of population size is available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the CGES Stock of common bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for the CGES Stock of common bottlenose dolphins is undetermined (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Central Georgia Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Undetermined

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the CGES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.2. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources (vessel strike) was 0.2. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.4 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

The commercial fishery that interacts, or has the potential to interact, with this stock is the Category II Atlantic blue crab trap/pot fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020 there was one documented entanglement interaction of a common bottlenose dolphin in the CGES Stock area in commercial blue crab trap/pot gear. The interaction was a mortality occurring in 2019, and is included in the annual human-caused mortality and serious injury total for this stock (Table 2), and also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab trap/pot fisheries. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2016–2020 within the CGES area, two common bottlenose dolphins were documented with evidence of vessel strikes. In 2019, a mortality was documented with well-healed vessel strike wounds and it was considered improbable the wounds contributed to the mortality. In 2020, another mortality was documented and it was determined the mortality was due to the vessel strike impact. Both of these mortalities were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). The 2020 vessel strike mortality was included in the annual human-caused mortality and serious injury total for this stock (Table 2).

All mortalities and serious injuries from known sources for the CGES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Central Georgia Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable.

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury Based on Observer Data	5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.2**	

Mean Annual Mortality due to other takes (2016–2020) (vessel strike)	**0.2**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)	**0.4**

Strandings

During 2016–2020, 24 common bottlenose dolphins were reported stranded within the CGES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for four of the strandings. No evidence of human interaction was detected for one stranding, and for the remaining 19 strandings it could not be determined if there was evidence of human interaction. Human interactions included an entanglement with commercial blue crab trap/pot gear and evidence of vessel strikes. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The CGES Stock has been affected by one unusual mortality event (UME) during the past 15 years. A UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015).

Table 3. Common bottlenose dolphin strandings occurring in the Central Georgia Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Central Georgia Estuarine System Stock	Total Stranded	7	3	4	3	7	24
	HI--Yes	0	1	0	2a	1b	4
	HI--No	0	0	0	0	1	1
	HI--CBD	7	2	4	1	5	19

a. Includes 1 animal with evidence of a vessel strike and 1 fisheries interaction, an entanglement interaction with commercial blue crab trap/pot gear (mortality).

b. Includes 1 animal with evidence of a vessel strike.

HABITAT ISSUES

This stock is found in relatively pristine estuarine waters of central Georgia. Much of the area has been privately owned since the end of the 19th century and has remained undeveloped, leaving the marshes relatively undisturbed. This stock's area includes the Sapelo Island National Estuarine Research Reserve, which is part of NOAA's National Estuarine Research Reserve system, and several National Wildlife Refuges. Just to the south of this stock's range, however, the estuarine environment around Brunswick, Georgia, is highly industrialized and the Environmental Protection Agency has included four sites within the Brunswick area as Superfund hazardous waste sites. This region is known to be contaminated with a specific PCB mixture, Aroclor 1268, in soil and sediments, and the transport of these contaminants into the food web through invertebrate and vertebrate fauna has been documented (Kannan *et al.* 1997; Kannan *et al.* 1998; Maruya and Lee 1998). Balmer *et al.* (2013) measured PCB concentrations in dolphins sampled near Sapelo Island and found concentrations, including detection of Aroclor 1268, lower than those found in dolphins from the Brunswick, Georgia area, but still high when compared to other common bottlenose dolphin stocks along the eastern seaboard. Given little evidence for movement of dolphins between these two areas (Balmer *et al.* 2011, 2013), the dolphins near Sapelo Island in the CGES Stock may be obtaining the high contaminant loads through eating contaminated prey (Balmer *et al.* 2011). Further work is necessary to examine contaminant and movement patterns of dolphin prey species in this region.

Studies have suggested an increased risk of detrimental effects on reproduction and endocrine and immune system function for marine mammals in relation to tissue concentrations of PCBs (De Swart *et al.* 1996; Kannan *et al.* 2000; Schwacke *et al.* 2002). PCB-related health effects on common bottlenose dolphins along the Georgia coast were examined through a capture-release health assessment conducted during 2009 in the Brunswick area and in waters near Sapelo Island (Schwacke *et al.* 2012). Results from hematology and serum chemistry indicated abnormalities, most notably that 26% of sampled dolphins were anemic. The dolphins also showed low levels of thyroid hormone, and thyroid hormones negatively correlated with PCB concentration measured in blubber. In addition, a reduction in innate and acquired immune response was found. T-lymphocyte proliferation and indices of innate immunity decreased with PCB concentration measured in blubber, indicating increased vulnerability to infectious disease. The high levels of PCBs recorded in dolphins from this stock, despite their relatively pristine environment, along with demonstrated PCB-related health effects, raise concern for the long-term health and viability of the stock.

Illegal feeding or provisioning of wild common bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Wu 2013; Kovacs and Cox 2014; Perrtree *et al.* 2014), which are just south and north of the CGES Stock area, respectively. Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the behavior and increase the risk of injury or death to wild dolphins. Dolphins in estuarine waters near Savannah recently showed the highest rate of begging behavior reported from any study site worldwide (Perrtree *et al.* 2014). There are links between provisioning wild dolphins, dolphin depredation of recreational fishing gear, begging behavior, and associated entanglement and ingestion of gear (Powell and Wells 2011; Christiansen *et al.* 2016; Hazelkorn *et al.* 2016; Powell *et al.* 2018).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. While the abundance of the CGES Stock is currently unknown, based on the previous abundance estimate (Waring *et al*. 2015), it is likely small and therefore relatively few mortalities and serious injuries would exceed PBR. The documented mean annual human-caused mortality for this stock for 2016–2020 was 0.4. However, it is likely the estimate of annual human-caused, including fishery-caused, mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of tidal salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=2.5), it exceeds the previous PBR for this stock based on a minimum abundance of 185. Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the previously calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Southern Georgia Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast from south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

Coastal southern Georgia contains an extensive estuarine tidal marsh system, punctuated with several river drainages. There is moderate development throughout the region, along with the largest industrialized area around Brunswick, Georgia. The Environmental Protection Agency has included four sites within the Brunswick area among the Superfund hazardous waste sites.

Balmer *et al.* (2011) conducted photo-ID studies from 2004 to 2009 in two field sites in south-central Georgia, one in the Turtle/Brunswick River estuary (TBRE) and the second north of the Altamaha River/Sound including the Sapelo Island National Estuarine Research Reserve and extending north to Sapelo Sound. Photo-ID data revealed strong site fidelity to the two regions and supported Altamaha Sound as an appropriate boundary between the two sites as 85.4% of animals identified did not cross Altamaha Sound (Balmer *et al.* 2013). Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South Carolina/Georgia Coastal Stock.

Figure 1. ***Geographic extent of the Southern Georgia Estuarine System (SGES) stock. Dashed lines denote the boundaries.***

In addition, bottlenose dolphins in the TBRE exhibit contaminant burdens consistent with long-term fidelity to the TBRE (Pulster and Maruya 2008; Balmer *et al.* 2011; Kucklick *et al.* 2011). Analyses to determine whether multiple demographically independent populations exist within this stock have not been performed.

The Southern Georgia Estuarine System Stock (SGES) is bounded in the south by the Georgia/Florida border at the Cumberland River through Cumberland Sound and in the north by the Altamaha River through Altamaha Sound inclusive, and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, Hampton River, St. Andrew and Jekyll Sounds and their tributaries, St. Simons Sound and tributaries, and the TBRE system (Figure 1). Although the majority of photo-ID survey effort by Balmer *et al.* (2013) was conducted within the estuaries, opportunistic surveys extending along the coast and satellite-linked telemetry of three individuals suggested that animals within the SGES had ranging patterns that extended into the coastal waters of the TBRE. Thus, the nearshore (≤ 1km from shore) coastal waters from Altamaha Sound to Cumberland Sound are included in the SGES Stock boundaries. The southern boundary abuts the northern boundary of the Jacksonville Estuarine System Stock, previously defined based on photo-ID and genetic data (Caldwell 2001). The northern boundary abuts the southern boundary of the Central Georgia Estuarine System Stock, and is defined based on continuity of estuarine habitat, evidence for significantly lower contaminant levels in dolphins from the Sapelo Island area (Balmer *et al.* 2011) and a genetic discontinuity between dolphins sampled in southern Georgia and those sampled in Charleston, South Carolina (Rosel *et al.* 2009). These boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of central and northern Georgia.

POPULATION SIZE

The current total number of common bottlenose dolphins residing within the SGES Stock is unknown because previous estimates are more than 8 years old (Table 1; NMFS 2016).

Earlier abundance estimates (>8 years old)

During 2008–2009, seasonal, mark-recapture, photo-ID surveys were conducted by Balmer *et al.* (2013) to estimate abundance in a portion of the SGES including St. Simons Sound north to and inclusive of Altamaha Sound. Estimates from winter were chosen as the best representation of the portion of resident estuarine stock in the area surveyed, and a random emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance estimate, based on winter 2008 and winter 2009 surveys, was 194 (CV=0.05; Balmer *et al.* 2013). It is important to note this estimate covered less than half of the entire range of the SGES Stock, and therefore, the abundance estimate is negatively biased.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the SGES Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock because only one estimate of population size is available.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the SGES Stock of common bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for this stock of common bottlenose dolphins is undetermined (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Southern Georgia Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Undetermined

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the SGES Stock during 2016–2020 is unknown.

The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.1. No additional mortality or serious injury was documented from other human-caused sources. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.1 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Fishery Information

The commercial fishery that interacts, or has the potential to interact, with this stock, is the Category II commercial Atlantic blue crab trap/pot fishery. Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020, there was one documented entanglement interaction of a common bottlenose dolphin in the SGES Stock area in commercial blue crab trap/pot gear. The interaction occurred during 2016 and the animal was released alive, but it could not be determined (CBD) whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). The CBD case was prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022) and was included in the annual human-caused mortality and serious injury total for this stock (see Table 2), and also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab trap/pot fisheries. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2016–2020 within the SGES area, there were two documented entanglements of common bottlenose dolphins in other gear types. In 2016, an animal was released alive following entanglement in a research seine, and this animal was considered not seriously injured (Maze-Foley and Garrison 2022). In 2017 an animal was released alive following entanglement in marine debris (Balmer *et al.* 2019), and it was considered not seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). Both of these entanglements of live animals were included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

All mortalities and serious injuries from known sources for the SGES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (Tursiops truncatus) of the Southern Georgia Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury	5-year Minimum Count Based on Stranding, At-Sea,

			Based on Observer Data	and/or MMAP Data
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	0.5*a
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.1**	
Mean Annual Mortality due to other takes (2016–2020)			**0***	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**0.1**	

a. One non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5) serious injuries based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022).

Strandings

During 2016–2020, 19 common bottlenose dolphins were reported stranded within the SGES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for three of the strandings. No evidence of human interaction was detected for four strandings, and for the remaining 12 strandings, it could not be determined if there was evidence of human interaction. Human interactions included an entanglement with commercial blue crab trap/pot gear, a research seine, and marine debris. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The SGES Stock area has been affected by one unusual mortality event (UME) during the most recent 15 years. A UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015). During 2015, Balmer *et al.* (2018) conducted a telemetry and health assessment study during which 19 common bottlenose dolphins were captured, satellite-linked tags were applied, and dolphins were tested for antibodies to dolphin morbillivirus (DMV). Using telemetry data, dolphins were classified into three ranging patterns referred to as estuary, sound and coastal. The findings of Balmer *et al.* (2018) supported those of Morris *et al.* (2015) and suggested that coastal animals, likely members of the South Carolina/Georgia Coastal Stock, were more exposed to DMV (based on DMV antibody titers) compared to animals from the SGES Stock (sound and estuary animals).

Table 3. Common bottlenose dolphin strandings occurring in the Southern Georgia Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from

the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Southern Georgia Estuarine System Stock	Total Stranded	5	7	3	3	1	19
	HI--Yes	2a	1b	0	0	0	3
	HI--No	1	2	1	0	0	4
	HI--CBD	2	4	2	3	1	12

a. Includes 1 entanglement in a research seine (released alive, not seriously injured) and 1 fisheries interaction, an entanglement interaction with commercial blue crab trap/pot gear (released alive, CBD if seriously injured).

b. Includes 1 entanglement in marine debris (released alive, not seriously injured).

HABITAT ISSUES

A portion of the stock's range is highly industrialized, and the Environmental Protection Agency has included four sites within the Brunswick area as Superfund hazardous waste sites. Specifically, the LCP Chemicals Site contaminated soils, groundwater and adjacent marsh with mercury and polychlorinated biphenyls (PCBs). Mean total polychlorinated biphenyl (PCB) concentrations from dolphins biopsied in the TBRE (Pulster and Maruya 2008; Sanger *et al.* 2008) were significantly higher than dolphins sampled in other areas of the world including other inshore estuarine waters along the Southeast coast of the United States, including the Gulf of Mexico (Schwacke *et al.* 2002; Hansen *et al.* 2004; Litz 2007; Balmer *et al.* 2011; Kucklick *et al.* 2011). PCB congeners measured in tissues of dolphins biopsied in the TBRE system were enriched in highly chlorinated homologs consistent with Aroclor 1268 (Pulster and Maruya 2008; Sanger *et al.* 2008, Balmer *et al.* 2011; Kucklick *et al.* 2011). The TBRE area is known to be contaminated with this specific PCB mixture in soil and sediments, and the transport of these contaminants into the food web through invertebrate and vertebrate fauna has been documented (Kannan *et al.* 1997; Kannan *et al.* 1998; Maruya and Lee 1998).

Studies have suggested an increased risk of detrimental effects on reproduction and endocrine and immune system function for marine mammals in relation to tissue concentrations of PCBs (De Swart *et al.* 1996; Kannan *et al.* 2000; Schwacke *et al.* 2002). PCB-related health effects on bottlenose dolphins along the Georgia coast were examined through a capture-release health assessment conducted during 2009 in the TBRE and in waters near Sapelo Island (Schwacke *et al.* 2012). Results from hematology and serum chemistry indicated abnormalities, most notably that 26% of sampled dolphins were anemic. Also, dolphins showed low levels of thyroid hormone, and thyroid hormones negatively correlated with PCB concentration measured in blubber. In addition, a reduction in innate and acquired immune response was found. T-lymphocyte proliferation and indices of innate immunity decreased with PCB concentration measured in blubber, indicating increased vulnerability to infectious disease. Overall, the results plainly showed that bottlenose dolphins are susceptible to PCB-related health effects (Schwacke *et al.* 2012). Thus, the high levels of PCBs recorded in dolphins from this stock, along with demonstrated PCB-related health effects, raise concern for the long-term health and viability of the stock.

In 2017, a dolphin with long-term site fidelity to the SGES area that was entangled in marine debris was captured for disentanglement (Balmer *et al.* 2019). During the disentanglement capture event, samples were also collected to assess the animal's health. Health results showed the animal to have high levels of site-specific contaminants, PCBs and Aroclor 1268, and to suffer from anemia. Balmer *et al.* (2019) note the possibility the chronic entanglement and associated blood loss could have played a role in the anemia; however, it is likely the anemia was a result of chronic PCB exposure (see Schwacke *et al.* 2012).

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Georgia, particularly near Brunswick and Savannah (Wu 2013; Kovacs and Cox 2014; Perrtree *et al.* 2014). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the behavior and increase the risk of injury or death to wild dolphins. There are links between provisioning wild dolphins, dolphin depredation of recreational fishing gear, begging behavior, and associated entanglement and ingestion of gear (Powell and Wells 2011; Christiansen *et al.* 2016; Hazelkorn *et al.* 2016; Powell *et al.* 2018).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and because of serious concerns regarding the health and reproduction of this stock. The documented mean annual human-caused mortality for the SGES Stock for 2016–2020 was 0.1. However, it is likely the estimate of annual human-caused, including fishery-caused mortality and serious injury, is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively more open and urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given that much of the habitat consists of tidal salt marshes. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses applying the 0.16 recovery rate (n=0.6), it does not exceed the previous PBR for this stock based on a minimum abundance of 185. However, NMFS has concerns for this stock because of the high mean total PCB concentrations found in the blubber of animals in this region which are believed to be having detrimental effects on health and reproduction (see Habitat Issues section). There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Jacksonville Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

The estuarine habitat around Jacksonville, Florida, is composed of several large brackish rivers, including St. Mary's, Amelia, Nassau, Fort George and St. Johns River (Figure 1). The St. Johns River is a deep, swift moving river with heavy boat and shipping activity (Caldwell 2001). The remainder of the area is made up of tidal marshes and riverine systems averaging 2 m in depth over sand, mud or oyster beds, and is bisected by the Intracoastal Waterway.

Figure 1. ***Geographic extent of the Jacksonville Estuarine System (JES) stock. Dashed lines denote the boundaries.***

Caldwell (2001; 2016a,b) investigated the social structure of common bottlenose dolphins inhabiting the estuarine waters between the St. Mary's River and Jacksonville Beach, Florida, using photo-ID and behavioral data obtained from December 1994 through December 1997. Three behaviorally different communities were identified during this study, namely the estuarine waters north of St. Johns River (termed the Northern area), the estuarine waters south of St. Johns River (the Southern area) and the coastal area, all of which differed in density, habitat fidelity and social affiliation patterns. Caldwell (2001; 2016b) found that dolphins inhabiting the Northern area were the most isolated and demonstrated strong year-round site fidelity. Cluster analyses suggested that dolphins using the Northern area did not socialize with those using the Southern area. In the Southern area, 78% of the groups were photographed only in this region but these dolphins moved into and out of the Jacksonville area each year, returning during three consecutive summers, suggesting the Southern area dolphins may show summer site fidelity as opposed to the year-round fidelity demonstrated in the Northern area (Caldwell 2001; 2016b). Caldwell (2001; 2016b) reported that dolphins found in the coastal areas were highly mobile, had fluid social affiliations, were not sighted more than eight times over the entire study and showed no long-term (> 4 months) site fidelity. Three of these dolphins were also sighted off South Carolina, behind shrimp boats. These coastal dolphins are thus considered to be members of a coastal stock. Caldwell

(2001) also examined genetic differentiation among the Northern, Southern and coastal areas of the study site using mitochondrial DNA sequences and microsatellite data. Both mitochondrial DNA haplotype and microsatellite allele frequencies differed significantly between the Northern and Southern sampling areas. Differentiation between the Southern sampling area and the coast was lower, but still significant. Rosel *et al.* (2009) also found evidence for genetic subdivision within samples collected in the Jacksonville region. These genetic data are in line with the behavioral analyses. However, sample sizes were small for these estuarine regions (n≤ 25) and genetic analyses did not account for the high number of closely related individuals within the dataset. Finally, Mazzoil *et al.* (2020) using photo-ID data further corroborated the isolation and site-fidelity of the dolphins in the northern portion of the stock area, illustrating that this pattern has temporal stability. They recommended Florida estuarine waters north of the St. Johns River (the northern Jacksonville Estuarine System (JES) stock region) be split from the JES Stock and made a separate stock whose northern border remains undetermined. These data combined suggest it is plausible there are multiple demographically independent populations of common bottlenose dolphins within the stock area. Further analyses are necessary to augment the genetic analyses, to explore the northern stock boundary of the JES Stock, and to determine whether the dolphins in the northern area exhibit demographic independence.

Gubbins *et al.* (2003) identified oscillating abundance year round for dolphins within the estuarine waters of this area, with low numbers reported in January and December. There was a positive correlation between dolphin abundance and water temperature, with peak numbers seen when water temperatures rose above 16°C.

The JES Stock has been defined as a separate estuarine stock based on the results of these photo-ID and genetic studies. It is bounded in the north by the Florida/Georgia border at Cumberland Sound, abutting the southern border of the Southern Georgia Estuarine System Stock, and extends south to Jacksonville Beach, Florida. Despite the strong fidelity to the Northern and Southern areas observed by Caldwell (2001; 2016b), some dolphins were photographed outside their preferred areas, supporting the proposal to include both these areas within the boundaries of the JES Stock. Mazzoil *et al.* (2020) identified dolphins from the southern portion of the JES Stock area utilizing the Intracoastal Waterway further south and suggested the southern boundary of the stock be extended to include estuarine waters as far south as the St. Augustine River inlet. Future analyses may provide additional information on the importance of the Southern area to the resident stock, and thus the inclusion of both areas in this stock boundary may be modified with additional data or further analyses.

Dolphins residing within estuaries south of this stock down to the northern boundary of the Indian River Lagoon Estuarine System Stock (IRLES) are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the JES Stock exhibit affiliation to the JES Stock, the IRLES Stock to the south or are simply transient animals associated with coastal stocks. Further research is needed to establish affinities of dolphins in this region. It should be noted that during 2016–2020, there were 29 stranded common bottlenose dolphins in this region in estuarine waters. There was evidence of human interaction for four of the strandings, including two interactions with hook and line fishing gear, one entanglement in commercial blue crab trap/pot gear, and one entanglement in unidentified rope/line. The two interactions with hook and line gear were both mortalities for which evidence suggested the hook and line gear contributed to cause of death. The entanglement in commercial blue crab trap/pot gear was a live release for which it could not be determined if the animal was seriously injured following mitigation efforts (initial determination was seriously injured; Maze-Foley and Garrison 2022). The entanglement in unidentified rope/line involved a live animal that shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison 2022). In addition to animals included in the stranding database, in estuarine waters south of JES there was one at-sea observation of a dolphin entangled in commercial blue crab trap/pot gear. The dolphin shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison 2022).

POPULATION SIZE

The total number of common bottlenose dolphins residing within the JES Stock is unknown because previous estimates are more than 8 years old (Table 1; NMFS 2016).

Earlier abundance estimates (>8 years old)

Data collected by Caldwell (2001; 2016a,b) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in four estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used, as this limited time period was determined to reduce the possibility of violating the mark-recapture model's assumption of geographic closure and mark retention. Based on photo-ID data from 1994 to 1997, 334 individually identified dolphins were observed (Gubbins *et al.* 2003), which included an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 334 individually identifiable dolphins, and the population size for the JES Stock was calculated to be 412 residents (CV=0.06; Gubbins *et al.* 2003). This was an overestimate of the stock abundance in the area covered by the study because it included non-resident and seasonally resident dolphins. Caldwell (2001; 2016b) indicated that 122 dolphins were resighted at least 10 times in the JES, with 33 individuals observed primarily in the Northern area, and 89 individuals reported to use the Southern area.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the JES Stock of common bottlenose dolphins.

Current Population Trend

One abundance estimate is available for this stock, and therefore there are insufficient data to assess population trends.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the JES Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for the JES Stock of common bottlenose dolphins is unknown (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Jacksonville Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Unknown

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the JES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 2.0. No additional mortality or serious injury was documented from other human-caused sources. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 2.0 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are the only data used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), and 5) strandings with evidence of fishery-related interactions occurred in waters south of the JES Stock boundary that are not included within any stock, and some or all of those strandings could have been part of this stock (see Stock Definition and Geographic Range section).

Fishery Information

There are three commercial fisheries that interact, or that potentially could interact, with this stock. These include two Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot and Atlantic blue crab trap/pot) and one Category III fishery (Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and *opportunistic at-sea observations.*

Trap/Pot

During 2016–2020 there were eight documented entanglement interactions of common bottlenose dolphins in the JES area with trap/pot fisheries. During 2016 there was one mortality and one animal disentangled from commercial blue crab trap/pot gear and released alive. It could not be determined (CBD) whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured (Maze-Foley and Garrison 2022). During 2017 there were three live animals entangled in commercial blue crab trap/pot gear for two cases and unidentified trap/pot gear in one case. For one case, the animal disentangled itself and was not considered seriously injured. For the remaining two cases, both animals were disentangled, and one was considered seriously injured post-mitigation (commercial blue crab trap/pot gear), and for the other case it could not be determined whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured; Maze-Foley and Garrison 2022). During 2018 there was one mortality in commercial blue crab trap/pot gear. During 2020 there were two live animals disentangled from commercial blue crab trap/pot gear. One animal was considered seriously injured, and for the second animal, it could not be determined whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured (Maze-Foley and Garrison 2022). The two mortalities, two live entanglements that were seriously injured, and three live entanglements that were CBD for serious injury (CBD cases were prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and were also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2016–2020 within the JES area, there were five documented interactions within the stranding data of common bottlenose dolphins entangled in or with ingested hook and line fishing gear. During 2016, there were two mortalities and one live animal considered seriously injured. For one of the mortalities, it could not be determined whether the hook and line gear interaction contributed to cause of death, and for the second mortality, available evidence suggested the hook and line gear did not contribute to cause of death. During 2017, there was one mortality and one animal considered seriously injured. For the mortality, evidence suggested the hook and line gear did not contribute to cause of death. The two serious injuries are included in the annual human-caused mortality and serious injury total for this stock (Table 2; Maze-Foley and Garrison 2022). All of these cases were included in the stranding database and in the stranding totals presented in Table 3 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

In addition to the interactions documented within the stranding data, two live common bottlenose dolphins were observed at-sea (in 2016 and 2017) entangled in hook and line fishing gear. Both dolphins were considered seriously injured, and are also included in the annual human-caused mortality and serious injury total for this stock (Table 2; Maze-Foley and Garrison 2022).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Other Mortality

There were no additional documented mortalities or serious injuries besides those described in the fisheries sections above. All mortalities and serious injuries from known sources for the JES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (*Tursiops truncatus*) of the Jacksonville Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and

fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).

Fishery	Years	Data Type	Mean Annual Estimated Mortality and Serious Injury Based on Observer Data	5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	5.5*a
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	0.5*b
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	4
Mean Annual Mortality due to commercial fisheries (2016–2020)			**2.0**	
Mean Annual Mortality due to other takes (2016–2020)			**0**	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**2.0**	

a. Includes two cases of CBD which were prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There was one case of a non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5). There was one case of a calf entanglement in which the post-mitigation determination was a CBD, and this case was prorated as a serious injury (1 serious injury). The two CBD cases were therefore prorated as 1.5 serious injuries.

b. One case of CBD which was prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There was one non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 (rounded to 0.5).

Strandings

During 2016–2020, 55 common bottlenose dolphins were reported stranded within the JES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for 19 of the strandings. For the remaining 36 strandings, it could not be determined if there was evidence of human interaction. Thirteen human interactions were from entanglements with trap/pot gear and hook and line gear as described above, and there was also evidence of vessel strike for two animals (one was also entangled in trap/pot gear). It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

The JES Stock has been affected by two unusual mortality events (UMEs) during the past 15 years. A UME was declared for the St. Johns River area during May–September 2010, including 14 strandings assigned to the JES Stock and four strandings within estuaries to the south not currently included in any stock assessment report. The cause of this UME was undetermined. An additional UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris et al. 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris et al. 2015). However, several confirmed morbillivirus positive animals were recovered from within the JES Stock area.

Table 3. Common bottlenose dolphin strandings occurring in the Jacksonville Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Jacksonville Estuarine System Stock	Total Stranded	11	10	11	15	8	55
	HI--Yes	7a	6b	1c	3d	2e	19
	HI--No	0	0	0	0	0	0
	HI--CBD	4	4	10	12	6	36

a. Includes 6 fisheries interactions (FIs), including 2 entanglement interactions with commercial blue crab trap/pot gear (1 mortality; 1 released alive, CBD if seriously injured), and 3 entanglement interactions with hook and line gear (2 mortalities; 1 released alive, seriously injured). In addition to the FIs, it also includes 1 entanglement in unidentified rope/line.

b. Includes 5 FIs, including 2 entanglement interactions with hook and line gear (1 mortality; 1 released alive, seriously injured), and 3 live entanglements in blue crab trap/pot gear (confirmed to be commercial gear in 2 cases - 1 seriously injured, 1 not seriously injured; and 1 CBD if seriously injured).

c. Includes 1 FI which was an entanglement interaction with commercial blue crab trap/pot gear (mortality, 3 sets of gear involved); this animal also had evidence of a vessel strike.

d. Includes 1 animal with evidence of a vessel strike (healed series of propeller scars).

e. Includes 2 FIs, both of which were live entanglements in commercial blue crab trap/pot gear (both released alive, 1 seriously injured and 1 CBD if seriously injured).

HABITAT ISSUES

This stock inhabits areas with significant drainage from industrial and urban sources, and as such is exposed to contaminants and nutrients in runoff from them. No contaminant analyses of dolphin tissues have yet been conducted in this area. In other estuarine areas where such analyses have been conducted, it has been suggested that exposure to anthropogenic contaminants could potentially result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Harmful algal blooms occur regularly in the St. Johns River (Brown *et al.* 2018). The most prevalent and persistent cyanotoxins from water samples collected in the St. Johns River, microcystins and nodularins, have been detected throughout the year. Dolphins utilizing this habitat may be exposed to these cyanotoxins. Brown *et al.* (2018) suggested that the high levels of human activity coupled with environmental stressors characterizing the St. Johns River could lead to the dolphins utilizing this area being more susceptible to the harmful effects of cyanotoxin exposure.

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. While the abundance of the JES Stock is currently unknown, based on the previous minimum abundance estimate (e.g., Caldwell (2001), it is likely small and therefore relatively few mortalities and serious injuries would exceed PBR. The documented minimum mean annual human-caused mortality for the JES stock for 2016–2020 was 2.0, with all mortalities having evidence of fishery interactions (crab trap/pot and hook and line gear). However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Sarasota Bay recovery rate may be most appropriate for this stock given that much of the habitat is urban. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.33 recovery rate (n=6.0), it exceeds PBR for this stock based on an older minimum abundance of 122 residents (Caldwell 2001). Total fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Indian River Lagoon Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, the coastal morphotype of common bottlenose dolphins is continuously distributed in nearshore coastal and estuarine waters along the U.S. Atlantic coast south of Long Island, New York, to the Florida peninsula. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (e.g., Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (e.g., Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

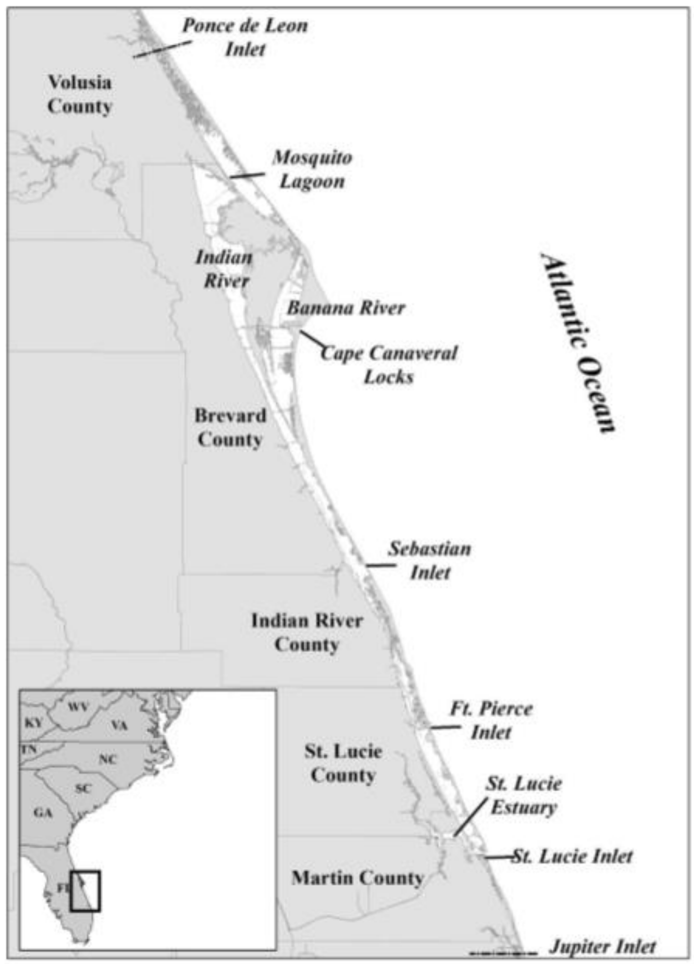

Figure 1. ***Geographic extent of the Indian River Lagoon Estuarine System (IRLES) Stock. Dashed lines denote the boundaries.***

Multiple studies utilizing varying methods such as photo-ID, radio telemetry, and genetics support the designation of common bottlenose dolphins in the Indian River Lagoon (IRL) as a distinct stock with long-term site fidelity to the region (Odell and Asper 1990; Mazzoil *et al.* 2005; Mazzoil *et al.* 2008a; Mazzoil *et al.* 2008b; Richards *et al.* 2013; Titcomb *et al.* 2015). Odell and Asper (1990) reported that none of the 133 freeze-branded dolphins from the IRL were observed outside of the system during their four-year monitoring period from 1979 to 1982 and suggested that there may be an additional discrete group of dolphins in the southern end of the system. Mazzoil *et al.* (2005) identified some of these freeze-branded animals in their 1996–2001 photo-ID study, with some dolphins being seen in the IRL over twenty years. Several photo-ID studies have provided evidence for spatial separation and minimal degree of movement between dolphins in the IRL and those occurring in the nearshore coastal waters of the Atlantic Ocean between Sebastian and St. Lucie Inlets (Mazzoil *et al.* 2008a; Mazzoil *et al.* 2011). However, two studies identified movement of some dolphins between the IRL and adjacent estuarine and/or coastal waters (Durden *et al.* 2011; Hartel *et al.* 2020; Mazzoil *et al.* 2020). Finally, within the IRL estuarine system, photo-ID and genetic data suggest multiple communities are present (Mazzoil *et al.* 2008a; Titcomb *et al.* 2015; Mazzoil *et al.* 2020). There is still a need to better understand movement patterns between the IRL and adjacent estuarine waters. Mazzoil *et al.* (2020) have suggested splitting the Mosquito Lagoon area out of the IRL estuarine system; further work to determine whether demographically independent populations inhabit these two areas will help determine whether this change should be made.

The Indian River Lagoon Estuarine System (IRLES) Stock on the Atlantic coast of Florida extends from Ponce de Leon Inlet in the north to Jupiter Inlet in the south and encompasses all estuarine waters in between (Figure 1), including but not limited to the Intracoastal Waterway, Mosquito Lagoon, Indian River, Banana River and the St. Lucie Estuary. Five inlets and the Cape Canaveral Locks connect the IRLES to the Atlantic Ocean. This definition of the IRLES has been used by a number of researchers (e.g., Kent *et al.* 2008; Durden *et al.* 2021).

Dolphins residing within estuaries north and south of this stock are currently not included in any Stock Assessment Report. It is unknown whether animals in estuarine waters south of the IRLES exhibit affiliation to the Biscayne Bay Stock or are simply transient animals associated with coastal stocks. Similarly, it is not known whether animals in estuarine waters north of the IRLES exhibit affiliation to the IRLES Stock or to the Jacksonville Estuarine System Stock to the north or are simply transients. There is limited estuarine habitat along the coastline south of the IRLES but some potentially suitable habitat north of the IRLES. Further research is needed to establish affinities of dolphins in these regions. It should be noted that during 2016–2020, there were 29 stranded common bottlenose dolphins in the region north of the IRLES in estuarine waters. There was evidence of human interaction for four of the strandings, including two interactions with hook and line fishing gear, one entanglement in commercial blue crab trap/pot gear, and one entanglement in unidentified rope/line. The two interactions with hook and line gear were both mortalities for which evidence suggested the hook and line gear contributed to cause of death. The entanglement in commercial blue crab trap/pot gear was a live release for which it could not be determined if the animal was seriously injured following mitigation efforts (initial determination was seriously injured; Maze-Foley and Garrison 2022). The entanglement in unidentified rope/line involved a live animal that shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison 2022). During 2016–2020 there was one estuarine stranding south of the IRLES for which evidence indicated interaction with an unknown fishery (healed scars). In addition to animals included in the stranding database, in estuarine waters north of the IRLES there was one at-sea observation of a dolphin entangled in commercial blue crab trap/pot gear. The dolphin shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison 2022).

POPULATION SIZE

The best available abundance estimate for the IRLES Stock of common bottlenose dolphins is 1,032 (95% CI:969–1,098; CV=0.03; Table 1). This is the mean estimate from four seasonal vessel-based capture-recapture photo-ID surveys conducted from summer 2016 to spring 2017 (Durden *et al.* 2021).

Earlier abundance estimates (>8 years old)

During photo-ID studies conducted in the IRLES for three years from 2002 to 2005, 615 common bottlenose dolphins with distinct dorsal fins were identified (Mazzoil *et al.* 2008a). This number of dolphins is comparable to abundances previously estimated (506–816 dolphins) based on small boat surveys (Mullin *et al.* 1990) and a mark-recapture study (Burn *et al.* 1987). Seasonal aerial surveys were conducted from summer 2002 through spring 2004 (Durden *et al.* 2011). Abundance estimates were lowest in summer and highest in winter, ranging from 362 (CV=0.29) for summer 2003 to 1,316 (CV=0.24) for winter 2002–2003 with an overall mean abundance of 662 (CV=0.09). The pattern of larger winter estimates occurred in both years of the Durden *et al.* (2011) study and was pronounced in two areas, Mosquito Lagoon and southern Indian River. Further aerial surveys were conducted from fall 2005 to winter 2010–2011, and as in the prior aerial surveys, estimates varied seasonally and differences were most pronounced in the Mosquito Lagoon and southern Indian River (Durden *et al.* 2017). Estimates ranged from 483 (95% CI:345–672) in summer 2008 to 1,947 dolphins (95% CI:1,198–2,590) in winter 2009– 2010, with an overall mean abundance of 1,032 dolphins (95% CI:809–1,255) (Durden *et al.* 2017).

Recent surveys and abundance estimates

Durden *et al.* (2021) conducted four seasonal vessel-based capture-recapture photo-ID surveys between August 2016 and May 2017 to estimate abundance of common bottlenose dolphins of the IRLES Stock. A robust design was used, with four seasonal primary periods, each with three secondary sessions. Surveys extended from Ponce Inlet in the north to Jupiter Inlet in the south and encompassed all estuarine waters in between. Coastal waters were not surveyed. The survey design included both alternating saw-tooth transects and depth-contour lines (~743 km in total length). Data were analyzed using program MARK via the RMark package in R. Estimates ranged from 981 (95% CI:882–1,090; CV=0.05) in winter to 1,078 (95% CI:968–1,201; CV=0.05) in summer. These estimates were corrected for the proportion of unmarked individuals. As there was little evidence for temporary emigration or transience for the IRLES Stock as a whole and the four seasonal estimates were similar, the best estimate for the IRLES Stock was the mean of the four seasonal estimates, 1,032 (95% CI:969–1,098; CV=0.03; Table 1).

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate for the IRLES Stock is 1,032 (CV=0.03). The resulting minimum population estimate is 1,004 (Table 1).

Current Population Trend

There are insufficient data to determine the population trends for this stock because of significant methodological differences in the surveys over time.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the IRLES Stock of common bottlenose dolphins is 1,004. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5 because this stock is of unknown status. PBR for the IRLES Stock of common bottlenose dolphins is 10.

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Indian River Lagoon Estuarine System Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
1,032	0.03	1,004	0.5	0.04	10

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the IRLES Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related (crab trap/pot and hook and line gear) was 3.9. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 1.8 (e.g., vessel strikes; see Other Mortality below). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 5.7 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are the only data used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), and 5) strandings with evidence of fishery-related interactions occurred in waters north and south of the IRLES Stock boundary that are not included within any stock, and some or all of those strandings could have been part of this stock (see Stock Definition and Geographic Range section).

Fishery Information

There are three commercial fisheries that interact, or that potentially could interact, with this stock. These include two Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot and Atlantic blue crab trap/pot) and one Category III fishery (Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020 there were five documented entanglement interactions of common bottlenose dolphins in the IRLES area with trap/pot fisheries. During 2016 there was one mortality and one live animal disentangled from commercial blue crab trap/pot gear and released alive. It could not be determined (CBD) whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured (Maze-Foley and Garrison 2022). During 2017 there was one mortality in commercial blue crab trap/pot gear (the animal was also entangled in hook and line gear). Also in 2017, there was one animal entangled in unidentified trap/pot gear, and this animal was considered not seriously injured following mitigation efforts (initial determination was seriously injured; Maze-Foley and Garrison 2022). During 2020 there was one live animal disentangled from commercial blue crab trap/pot gear, and it could not be determined whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured (Maze-Foley and Garrison 2022). All of these entanglement interactions were documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). The two mortalities and two live entanglements that were CBD for serious injury (CBD cases were prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Previous interactions between common bottlenose dolphins and the blue crab fishery in the IRLES were examined by Noke and Odell (2002), who observed behaviors that included dolphins closely approaching crab boats, begging, feeding on discarded bait and crab pot tipping to remove bait from the pot. See Noke and Odell (2002) for further information.

Hook and Line

During 2016–2020, within the IRLES area, there were 24 documented interactions within the stranding data of common bottlenose dolphins entangled in or with ingested hook and line fishing gear (in 2016 [n=4], 2017 [n=9], 2018 [n=3], 2019 [n=4] and 2020 [n=4]). During 2016, there were three mortalities and one live animal considered not seriously injured following mitigation efforts (the initial determination was seriously injured (Maze-Foley and Garrison 2022)). For two of the mortalities, available evidence suggested the hook and line gear did not contribute to cause of death, and for the third mortality, evidence suggested the gear did contribute to cause of death (this animal was also entangled in a monofilament cast net). During 2017, there were six mortalities; for three of these mortalities, evidence suggested the hook and line gear contributed to cause of death (one of these animals was also entangled in commercial blue crab trap/pot gear; one mortality was described in Marks *et al.* 2020), and for the remaining three mortalities, evidence suggested the hook and line gear did not contribute to cause of death. Also in 2017, there were three live animals considered not seriously injured following mitigation efforts (the initial determinations were seriously injured (Maze-Foley and Garrison 2022). During 2018, there were three mortalities; for two of these mortalities, evidence suggested the hook and line gear contributed to cause of death, and for the remaining mortality, evidence suggested the hook and line gear did not contribute to cause of death. During 2019, there were also three mortalities; for two of these mortalities, evidence suggested the hook and line gear contributed to cause of death, and for the remaining mortality, evidence suggested the hook and line gear did not contribute to cause of death. Also in 2019, one live animal was considered seriously injured (Maze-Foley and Garrison 2022). During 2020, there were also three mortalities; for two of these mortalities, evidence suggested the hook and line gear contributed to cause of death, and for the remaining mortality, it could not be determined whether the hook and line gear contributed to cause of death. Also in 2020, there was one live animal for which it could not be determined whether the animal was seriously injured following mitigation efforts (the initial determination was seriously injured [Maze-Foley and Garrison 2022]). The 10 mortalities for which evidence suggested the hook and line gear contributed to cause of death, the one serious injury, and the one live animal for which it could not be determined (CBD) whether it was seriously injured (the CBD case was prorated based on previous assignable injury events; NMFS 2012; Maze-Foley and Garrison 2022) are included in the annual human-caused mortality and serious injury total for this stock (Table 2). All of these cases were included in the stranding database and in the stranding totals presented in Table 3 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

In addition to the interactions documented within the stranding data, seven live common bottlenose dolphins were observed at-sea (in 2016 [n=2], 2017 [n=1], 2019 [n=1] and 2020 [n=3]) entangled in hook and line fishing gear. Five dolphins were considered seriously injured and are included in the annual human-caused mortality and serious injury total for this stock (Table 2). The remaining two dolphins were considered not seriously injured (Maze-Foley and Garrison 2022).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

For additional information on historic interactions with hook and line gear for common bottlenose dolphins in the IRLES, see Stolen *et al.* (2012).

Other Mortality

During 2016–2020 within the IRLES area, there were six documented interactions of common bottlenose dolphins in other gear types or from other human-caused sources. There were four documented mortalities: one mortality (2016) involving an entanglement in a monofilament cast net (this animal was also entangled in hook and line gear); a second mortality (2017) had a large metal rod in its forestomach and severe lacerations to its rostrum; a third mortality (2018) resulted from entanglement in a navigational buoy; and a fourth mortality (2018) resulted from an entanglement in unknown fishing gear (this animal was also entangled in hook and line gear). In addition, there were two live animals considered not seriously injured following mitigation efforts (the initial determinations were seriously injured [Maze-Foley and Garrison 2022]). One live animal was entangled in a Hawaiian sling/spear and the other was trapped within a construction boom. All of these cases were included in the stranding database and in the stranding totals presented in Table 3 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). Two of the mortalities are included in the annual human-caused mortality and serious injury total for this stock as part of "other takes" (Table 2). The two mortalities also entangled in hook and line gear are already counted under that gear type.

Also during 2016–2020 within the IRLES area, there were four documented mortalities of common bottlenose dolphins with evidence of a vessel strike. In two cases, evidence suggested the vessel strike contributed to cause of death, and these two mortalities are included in the annual human-caused mortality and serious injury total for this stock (Table 2). All of these cases were included in the stranding database and in the stranding totals presented in Table 3 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). An earlier study by Bechdel *et al.* (2009), using data from 1996 to 2006, examined impacts of motorized vessels on common bottlenose dolphins in the IRLES suggested that continual vessel avoidance, lack of rest, and projected increases in anthropogenic impacts may result in chronic stress for dolphins inhabiting the IRLES.

In addition to the interactions documented within the stranding data and those described in the Hook and Line section above, during 2016–2020, seven live common bottlenose dolphins were observed at-sea (2017 [n=4], 2018 [n=2], and 2019 [n=1]) entangled in unidentified gear or with evidence of a vessel strike. Three animals were considered seriously injured due to entanglement in unidentified gear, and two were considered seriously injured due to a vessel strike (Maze-Foley and Garrison 2022). These five serious injuries are included in the annual human-caused mortality and serious injury total for this stock (Table 2).

All mortalities and serious injuries from known sources for the IRLES Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (**Tursiops truncatus*****) of the Indian River Lagoon Estuarine System Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).***

Fishery	Years	Data Type	Mean Annual Estimated Mortality	5-year Minimum Count Based on

			and Serious Injury Based on Observer Data	**Stranding, At-Sea, and/or MMAP Data**
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	3.5*[a]
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	16*[b]
Mean Annual Mortality due to commercial fisheries (2016–2020)			**3.9**	
Mean Annual Mortality due to other takes (2016–2020) (other fishing gear, unidentified gear, vessel strikes)			**1.8***	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**5.7**	

a. Includes two cases of CBD which were prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There was one non-calf entanglement in which the post-mitigation determination was CBD, and this CBD was prorated as 0.46 (rounded to 0.5) serious injuries. There was one calf entanglement in which the post-mitigation determination was CBD, and it was prorated as a serious injury (1 serious injury). Therefore, the total for these two CBD cases was 1.5 serious injuries.

b. Includes one calf entanglement in which the post-mitigation determinations was CBD. The CBD was prorated as not seriously injured (0 serious injuries) based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022).

Strandings

During 2016–2020, 187 common bottlenose dolphins were reported stranded within the IRLES Stock area (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). There was evidence of human interaction for 48 of the strandings. No evidence of human interaction was detected for 23 strandings, and for the remaining 116 strandings, it could not be determined if there was evidence of human interaction. Human interactions were from numerous sources, including entanglements with commercial blue crab trap/pot gear, hook and line gear, unidentified fishing gear, as well as a cast net, and a sling/spear. There was also a boom entrapment, an entanglement in a navigational buoy, evidence of vessel strikes for several animals, and an animal found with a metal rod in its forestomach. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

For more information on historic stranding data (1977–2005) from the IRLES, see Stolen *et al.* (2007), who examined spatio-temporal aspects of strandings, age/sex specific mortality patterns and human-related mortality in the IRLES.

The IRLES Stock has been experiencing Unusual Mortality Events (UMEs) since at least 1982 (Lipscomb *et al.* 1994; Duignan *et al.* 1996; Bossart *et al.* 2010; Brightwell *et al.* 2020; https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events). During the past 15 years, the IRLES has experienced three UMEs. From May to August of 2008, a total of 47 common bottlenose dolphins were recovered from the northern IRLES. One dolphin from the Central Florida Coastal Stock was also considered part of this UME (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Infectious disease is suspected as a possible cause of this event. During January to December 2013, another UME occurred within the IRLES. Elevated strandings occurred in the northern and central IRLES in Brevard County. The cause of this UME was undetermined. An additional UME occurred during 2013–2015 along the Atlantic coast of the U.S. and was attributed to morbillivirus (Morris *et al.* 2015). The total number of stranded common bottlenose dolphins from New York through North Florida (Brevard County) during the 2013–2015 UME was 1,614 (https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2015-bottlenose-dolphin-unusual-mortality-event-mid-atlantic, accessed 13 November 2019). Most strandings and morbillivirus positive animals were recovered from the ocean side beaches rather than from within the estuaries, suggesting that coastal stocks may have been more impacted by this UME than estuarine stocks (Morris *et al.* 2015). However, several confirmed morbillivirus positive animals were recovered from within the IRLES Stock area.

Table 3. Common bottlenose dolphin strandings occurring in the Indian River Lagoon Estuarine System Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

COUNTY		**2016**	**2017**	**2018**	**2019**	**2020**	**TOTAL**
Volusia	Total Stranded	8	7	9	7	5	36
	HI--Yes	3	3	7	1	3	17
	HI--No	3	0	1	0	0	4
	HI--CBD	2	4	1	6	2	15
Seminole	Total Stranded	0	0	0	0	0	0
Brevard	Total Stranded	36	22	24	23	33	138
	HI--Yes	4	7	4	7	2	24
	HI--No	5	3	4	0	4	16
	HI--CBD	27	12	16	16	27	98
Indian River	Total Stranded	1	0	2	0	1	4
	HI--Yes	0	0	2	0	0	2
	HI--No	1	0	0	0	0	1
	HI--CBD	0	0	0	0	1	1

St. Lucie	Total Stranded	0	3	0	1	1	5
	HI--Yes	0	2	0	0	0	2
	HI--No	0	1	0	0	0	1
	HI--CBD	0	0	0	1	1	2
Martin	Total Stranded	1	2	0	0	1	4
	HI--Yes	1	1	0	0	1	3
	HI--No	0	1	0	0	0	1
	HI--CBD	0	0	0	0	0	0
TOTAL	Total Stranded	46	34	35	31	41	187
	HI--Yes	8	13	13	8	6	48
	HI--No	9	5	5	0	4	23
	HI--CBD	29	16	17	23	31	116

HABITAT ISSUES

The IRLES is a shallow water estuary with little tidal influx, which limits water exchange with the Atlantic Ocean. This allows for accumulation of land-based effluents and contaminants in the estuary, as well as fresh-water dilution from run-off and rivers. A large portion of Florida's agriculture also drains into the IRLES (Miles and Pleuffer 1997). Dolphins in the IRLES were found to have concentrations of contaminants at levels of possible toxicological concern. Hansen *et al.* (2004) suggested that polychlorinated biphenyl (PCBs) concentrations in blubber samples collected from remote biopsy of IRLES dolphins were sufficiently high to warrant additional sampling. Fair *et al.* (2010) found potentially harmful levels of several different chemical contaminants, including some that may act as endocrine disruptors. Mercury levels have also been found to be high in dolphins from the IRLES, with some levels associated with toxic effects in marine mammals (Durden *et al.* 2007; Stavros *et al.* 2007; 2008; 2011). In addition, concentrations appear to be higher in the northern portion of the IRLES compared to the southern portions (Schaefer *et al.* 2015; Titcomb *et al.* 2017). Concentrations of total mercury in IRLES dolphins were associated with lower levels of total thyroxine, triiodothyronine, lymphocytes, eosinophils and platelets and increases in blood urea nitrogen and gamma-glutamyl transferase (Schaefer *et al.* 2011). However, there have been no reports of mortalities in the IRLES resulting solely from contaminant concentrations.

In addition to contaminants, other aspects of water quality of the IRLES are a serious concern. Nonpoint source sewage pollution from septic tanks is a major contributor of eutrophication, or nutrient over-enrichment, to the system (Barile 2018; Lapointe *et al.* 2020; Greller *et al.* 2021), and has led to persistent harmful algal blooms (HABs) within the IRLES (Lapointe *et al.* 2020; Laureano-Rosario *et al.* 2021). During 2011–2017 following unprecedented HABs, the IRLES experienced a widespread loss of ~95% of seagrass (Lapointe *et al.* 2020; Greller *et al.* 2021). Severe weather events, such as hurricanes, tropical storms, and El Niño periods, can also increase nutrient loads and contribute to HABs, and there is concern that with future changes in climate, such as an increase in intensity and occurrence of hurricanes and El Niño periods, the threats for HABs will increase within the IRLES (Phlips *et al.* 2020). Common bottlenose dolphins inhabiting the IRLES are at risk from exposure to and accumulation of neurotoxins produced by HAB species. Fire *et al.* (2020) examined liver tissue samples over 10 years and demonstrated that exposure to brevetoxin and saxitoxin occurred within dolphins in the IRLES even in the absence of detectable blooms. Health impacts of the toxin exposure are unknown (Fire *et al.* 2020). It should be noted that starting in December 2020, a high number of manatee mortalities have occurred in the IRLES as part of an ongoing manatee UME along the Atlantic Coast of Florida. The UME has been attributed to starvation due to the loss of seagrass within the IRLES as a result of poor water quality (https://myfwc.com/research/manatee/rescue-mortality-response/ume/). Whether the loss of seagrass beds may impact dolphin prey species such as pinfish that are dependent on those beds is unknown.

Recent studies of IRLES dolphins have shown evidence of infection with the cetacean morbillivirus. Positive morbillivirus titers were found in 12 of 122 (9.8%) live IRLES dolphins sampled between 2003 and 2007 (Bossart *et al.* 2010). In addition, approximately 6 to 10% of common bottlenose dolphins had lacaziosis (lobomycosis), a chronic mycotic disease of the skin caused by *Lacazia loboi* (Reif *et al.* 2006; Murdoch *et al.* 2008). There are no published reports of mortalities resulting solely from this disease. Finally, Bossart *et al.* (2015) examined mucocutaneous lesions in free ranging common bottlenose dolphins within the IRLES area and found the presence of orogenital sessile papillomas, cutaneous lobomycosis, tattoo skin disease, nonspecific chronic to chronic-active dermatitis, and epidermal hyperplasia. The study suggested the high prevalence of lesions may reflect chronic exposure to anthropogenic and environmental stressors, such as contaminants and infectious or inflammatory disease.

Feeding or provisioning of wild common bottlenose dolphins has been documented in Florida, including areas of the Indian River Lagoon (Marks *et al.* 2020). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter the natural behavior and increase the risk of injury or death to wild dolphins. There are links between provisioning wild dolphins, dolphin depredation of recreational fishing gear, begging behavior, and associated entanglement and ingestion of gear (Powell and Wells 2011; Christiansen *et al.* 2016; Hazelkorn *et al.* 2016; Powell *et al.* 2018).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. The documented minimum mean annual human-caused mortality for the IRLES stock for 2016–2020 was 5.7, with an annual average of 3.9 carcasses showing evidence of fishery interaction (crab trap/pot and hook and line gear) and 1.8 from other sources (e.g., vessel strikes, unknown fishing gear). This represents a minimum of nearly 60% of the IRLES Stock's PBR. However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Sarasota Bay recovery rate may be most appropriate for this stock given that much of the habitat is urbanized and relatively open. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.33 recovery rate (n=17), it exceeds the PBR for this stock based on a minimum abundance of 1,004. Total U.S. fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Biscayne Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Rosel *et al.* 2009; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Sellas *et al.* 2005; Balmer *et al.* 2008; Rosel *et al.* 2017).

Figure 1. ***Geographic extent of the Biscayne Bay Stock. Dashed lines at Haulover Inlet and Card Sound Bridge denote the boundaries.***

Biscayne Bay is a shallow estuarine system located along the southeast coast of Florida in Miami-Dade County. The Bay is generally shallow (depths <5 m) and includes a diverse range of benthic communities including seagrass beds, soft coral and sponge communities, and mud flats. The northern portion of the Bay (Figure 1) is surrounded by the cities of Miami and Miami Beach and is therefore heavily influenced by industrial and municipal pollution sources. Furthermore, tidal flushing in this portion of the Bay is severely limited by the presence of dredged islands (Bialczak *et al.* 2001). In contrast, the central and southern portions of the Bay are less influenced by development and are better flushed. Water exchange with the Atlantic Ocean occurs through a broad area of grass flats and tidal channels termed the Safety Valve near the center of the Bay.

The Biscayne Bay Stock of common bottlenose dolphins has been the subject of an ongoing photo-ID study conducted by the NMFS Southeast Fisheries Science Center (SEFSC) since 1990. From 1990 to 1991, preliminary information was collected focusing on the central portion of the Bay. The survey was re-initiated in 1994, and it was expanded to include the northern portion of the Bay and south to the Card Sound Bridge in 1995 (Litz 2007). Photo-ID surveys were expanded further south through Barnes Sound to the Barnes Sound Bridge in 2008, and as of 2021, the photo-ID catalog contains more than 400 marked individuals. Many of these individuals are long-term residents with multiple sightings over the course of the study (Litz *et al.* 2012). Litz (2007) documented two social groups that differentially utilize habitats within Biscayne Bay; one group was sighted primarily in the northern half of the Bay while the other was sighted primarily in the southern half. Members of these two groups exhibited significant differences in contaminant loads (Litz *et al.* 2007). Evidence of weak but significant genetic differentiation was found between these two social groups using microsatellite data but not mitochondrial DNA (mtDNA) data (Litz *et al.* 2012). The lack of differentiation at mtDNA coupled with field observations indicating overlapping home ranges for these two groups suggests ongoing, though perhaps low, levels of interbreeding and the two groups have not been split into separate stocks at this time. However, significant genetic differentiation was found between Biscayne Bay and Florida Bay dolphins at both marker types (Litz *et al.* 2012). The observed genetic differences between resident animals in Biscayne Bay and those in an adjacent estuary combined with the high levels of site fidelity observed, demonstrate that the resident Biscayne Bay common bottlenose dolphins are a demographically independent population. Further work is needed to evaluate the degree of demographic independence between the two groups that utilize different habitats within the bay, given the evidence for a measurable level of nuclear genetic differentiation between them (Litz *et al.* 2012).

Biscayne Bay extends south through Card Sound and Barnes Sound, and connects through smaller inlets to Florida Bay (Figure 1). The Biscayne Bay Stock of common bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound bridge to the south. This range corresponds to the extent of confirmed home ranges of common bottlenose dolphins observed residing in Biscayne Bay by a long-term photo-ID study(Litz 2007) and probably represents the core range of this stock. Preliminary comparisons of the Biscayne Bay catalog with catalogs from Florida Bay indicate there is spatial overlap of these two genetically distinct stocks near the stock boundary and/or within Barnes Sound. Thus, Biscayne Bay dolphins may utilize habitats outside these boundaries, including Barnes Sound, and so this southern boundary is subject to change upon further study. NMFS SEFSC has entered its catalog into the Gulf of Mexico Dolphin Identification System (GoMDIS; https://sarasotadolphin.org/gomdis/) to further investigate this possibility.

Dolphins residing within estuaries north of this stock to Jupiter Inlet are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay Stock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2016–2020, there was one stranded common bottlenose dolphin in unassigned estuarine habitat north of the Biscayne Bay Stock. There was evidence of human interaction for this stranding in the form of healed fishery interaction marks.

POPULATION SIZE

The total number of common bottlenose dolphins residing within the Biscayne Bay Stock is unknown (Table 1).

Earlier abundance estimates (>8 years old)

An initial evaluation of the abundance of common bottlenose dolphins in Biscayne Bay was conducted with aerial surveys in 1974–1975 covering predominantly the central portion of the Bay from Rickenbacker Causeway to the northern end of Card Sound. Common bottlenose dolphins were observed in the Bay on seven of 22 aerial surveys with the sightings totaling 67 individuals. Only one group was seen on each survey. This led the authors to conclude that there was likely one herd of approximately 13 animals occupying the Bay (Odell 1979).

Between 1994 and 2007, 394 small boat surveys of Biscayne Bay were conducted for a common bottlenose dolphin photo-ID study. A day's survey effort covered either the northern (Haulover Inlet to Rickenbacker Causeway), central (Rickenbacker Causeway to Sands Cut) or southern (Sands Cut to Card Sound Bridge) region of the Bay. Each area was surveyed 8–12 times per year on a monthly basis from 1994 to 2003. From 2003 to 2007, the number of surveys was lower and ranged between four and eight per year, and the lowest amount of effort was expended in the southern portion of the Bay. Using standard methods (Litz 2007), there were 157 unique individuals identified by the photo-ID surveys between 2003 and 2007. However, this catalog size does not represent a valid estimate of population size because the residency patterns of dolphins in Biscayne Bay are not fully understood. Research is currently underway to estimate the abundance of the Biscayne Bay Stock using a photographic mark-recapture method.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the Biscayne Bay Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Biscayne Bay Stock of common bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Biscayne Bay Stock of common bottlenose dolphins is unknown (Table 1).

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Biscayne Bay Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV	Nmin	Fr	Rmax	PBR
Unknown	-	Unknown	0.5	0.04	Unknown

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Biscayne Bay Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.6. Additional mean annual mortality and serious injury during 2016–2020 due to other human-caused sources was 0.2 (vessel strike). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.8 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), and 5) a stranding with evidence of fishery-related interactions occurred in waters north of the Biscayne Bay Stock boundary that is not included within any stock, and the stranding could have been part of this stock (see Stock Definition and Geographic Range section).

Fishery Information

There are four commercial fisheries that interact, or that potentially could interact, with this stock. These include two Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot and Atlantic blue crab trap/pot) and two Category III fisheries (Florida spiny lobster trap/pot; and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Trap/Pot

During 2016–2020 there were two documented entanglement interactions of common bottlenose dolphins in Biscayne Bay with trap/pot fisheries. In 2020, one animal was disentangled from commercial blue crab trap/pot gear and released alive. Also in 2020, another animal was disentangled from unidentified trap/pot gear and released alive. For both cases, the animals were considered to be seriously injured following mitigation efforts (Maze-Foley and Garrison 2022). These live entanglements are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and were also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2016–2020 within the Biscayne Bay area, there was one documented interaction of a common bottlenose dolphin with ingested hook and line fishing gear. During 2018, there was one mortality where monofilament line was wrapped around the goosebeak and evidence suggested the hook and line gear contributed to the cause of death. This case was included in the annual human-caused mortality and serious injury total for this stock (Table 2), and it was included within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat and headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no observer program. The documented interaction in this gear represents a minimum known count of interactions in the last five years.

Other Mortality

During 2018, there was one mortality documented with wounds consistent with a vessel strike, and it was determined the mortality was due to the vessel strike. This mortality was included within the annual human-caused mortality and serious injury total for this stock (Table 2) as well as the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021).

All mortalities and serious injuries from known sources for the Biscayne Bay Stock are summarized in Table 2.

Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (**Tursiops truncatus*****) of the Biscayne Bay Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).***

Fishery	**Years**	**Data Type**	**Mean Annual Estimated Mortality and Serious Injury Based on Observer Data**	**5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data**
Commercial Blue Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Unidentified Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	1
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	1
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.6**	

Mean Annual Mortality due to other takes (2016–2020) (vessel strike)	**0.2**
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)	**0.8**

Strandings

During 2016–2020, nine common bottlenose dolphins were reported stranded within Biscayne Bay (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 18 November 2021). There was evidence of human interaction for four of the strandings. For the remaining five strandings, it could not be determined if there was evidence of human interaction. Human interactions were from entanglements with trap/pot gear, hook and line gear, and a vessel strike. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement, or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

Table 3. Common bottlenose dolphin strandings occurring in the Biscayne Bay Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Biscayne Bay Stock	Total Stranded	2	1	2	1	3	9
	HI--Yes	0	0	2[a]	0	2[b]	4
	HI--No	0	0	0	0	0	0
	HI--CBD	2	1	0	1	1	5

a. Includes 1 entanglement interaction with hook and line gear (mortality) and 1 mortality with evidence of a vessel strike.

b. Includes 1 entanglement interaction with commercial blue crab trap/pot gear and 1 entanglement interaction with unidentified trap/pot gear (both animals released alive, seriously injured).

HABITAT ISSUES

The nearshore and estuarine habitats occupied by dolphins in Biscayne Bay are adjacent to areas of high human population and some are highly industrialized. Studies have examined persistent organic pollutant concentrations in common bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high pollutant concentrations in blubber, particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). A study of persistent organic pollutants in common bottlenose dolphins of Biscayne Bay demonstrated a strong geographic gradient in pollutant concentrations between dolphins with sighting histories primarily in the northern, more polluted areas compared to dolphins with ranges in the southern portion of the Bay (Litz *et al.* 2007). The observed tissue concentrations of polychlorinated biphenyls (PCBs) for male animals from the northern Bay were five times higher than those in southern Biscayne Bay and were also higher than those of dolphins from other Atlantic estuaries including Beaufort, North Carolina, Charleston, South Carolina, Indian River Lagoon, Florida, and Florida Bay (Litz *et al.* 2007). These findings demonstrate differential exposure of common bottlenose dolphins to pollutants through the food chain on a very fine spatial scale within Biscayne Bay and between estuaries.

Eutrophication poses a threat to water quality throughout Biscayne Bay, especially in the northern portion of the bay. A twenty-year study (1995–2014) conducted within the bay found that concentrations of both chlorophyll a and phosphates increased throughout the bay, with concentrations increasing at a higher rate in northern Biscayne Bay (Millette *et al.* 2019). Their findings coupled with recent seagrass die-offs, fish kills due to low levels of dissolved oxygen, and harmful algal blooms, indicate water quality is declining (Millette *et al.* 2019).

STATUS OF STOCK

Common bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, this stock is considered strategic under the MMPA because the documented mortalities and serious injuries are incomplete and biased low, and likely exceed PBR when corrected for unrecovered carcasses. The documented mean annual human-caused mortality for the Biscayne Bay Stock for 2016–2020 was 0.8. However, it is likely the estimate of annual fishery-caused mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively more open and urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Sarasota Bay recovery rate may be most appropriate for this stock given that much of the habitat is urban and relatively open. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses applying the 0.33 recovery rate (n=2.4), it exceeds the PBR for this stock based on an older minimum abundance of ~157 residents (Litz 2007). Total U.S. fishery-related mortality and serious injury for this stock is unknown, but at a minimum is greater than 10% of the PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. There is also uncertainty as to the level of demographic independence between two groups of dolphins that utilize different habitats within the bay. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine population trends for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*) Florida Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sounds, and estuaries (BSE) of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every estuarine site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009; Bassos-Hull *et al.* 2013; Wells *et al.* 2017; Balmer *et al.* 2018). In many cases, residents occur predominantly within estuarine waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006; Bassos-Hull *et al.* 2013; Wells *et al.* 2017).

Genetic data also support the concept of relatively discrete, demographically independent BSE populations in the Gulf of Mexico (Duffield and Wells 2002; Sellas *et al.* 2005; Rosel *et al.* 2017). Sellas *et al.* (2005) examined population subdivision among dolphins sampled in Sarasota Bay, Tampa Bay, and Charlotte Harbor, Florida; Matagorda Bay, Texas; and the coastal Gulf of Mexico (1–12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant genetic population differentiation among all areas. Genetic data also indicate restricted genetic exchange between and demographic independence of BSE populations and those occurring in adjacent Gulf coastal waters (Sellas *et al.* 2005; Rosel *et al.* 2017). Photo-ID and genetic data from several inshore areas of the southeastern United States Atlantic coast also support the existence of resident estuarine animals and differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al.* 2009).

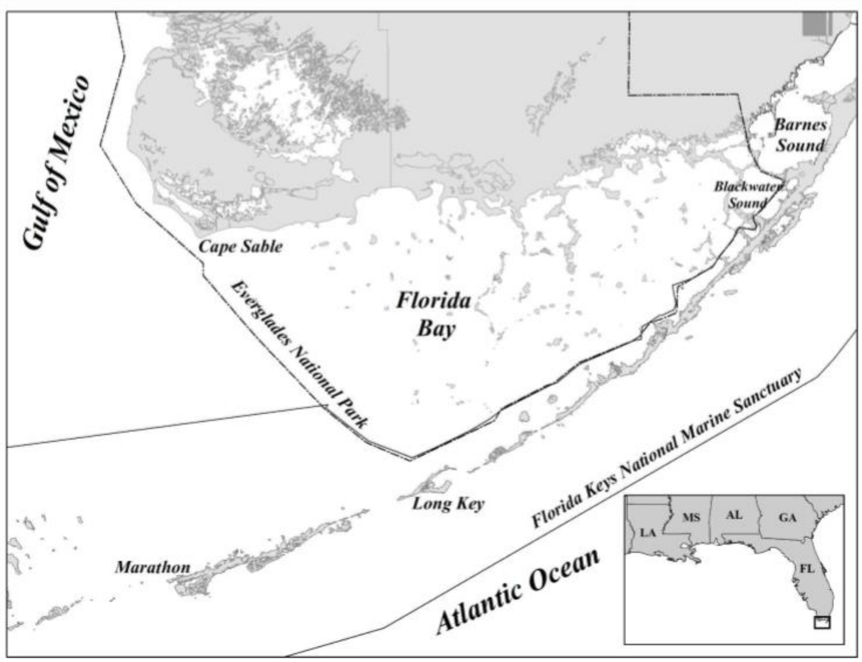

Figure 1. ***Geographic extent of the Florida Bay Stock. The boundaries of Everglades National Park and Florida Keys National Marine Sanctuary are shown.***

Florida Bay is a shallow estuarine system that encompasses 2,200 km2 of interconnected basins, grassy mud banks and mangrove islands. Florida Bay is bordered by the Florida mainland to the north, by the Florida Keys and Atlantic Ocean to the southeast, and by the Gulf of Mexico to the west. The western boundary of the Everglades National Park is generally considered to be the boundary between Florida Bay and the Gulf of Mexico. Here, Barnes Sound is not considered to be part of Florida Bay (Figure 1). Florida Bay was historically fed by runoff from the Everglades through marsh-like prairies called sloughs and a number of nearby creeks or inlets. The Bay connects through smaller inlets to Biscayne Bay, between Blackwater Sound and Barnes

Sound. Freshwater flow from the Everglades is a major influence on the conditions within the Bay, particularly since tides have little effect on water levels due to mud banks that restrict water flow (Fourqurean and Robblee 1999).

During 1995–1997, aerial surveys were conducted in Florida Bay to census bird populations, and opportunistic sightings of common bottlenose dolphins were recorded. While these surveys did not estimate the abundance of common bottlenose dolphins, the surveys documented the presence of dolphins in Florida Bay throughout the year (McClellan *et al.* 2000). Engleby *et al.* (2002) also recorded dolphins year round in a photo-ID study performed during 1999–2000 with the majority of sightings in the southern portion of the bay. Torres (2007) conducted surveys during summers (June–August) from 2002 to 2005 and found that dolphins were present in all areas of the Bay. Sarabia *et al.* (2018) recorded dolphins in northern Florida Bay from Cape Sable to Flamingo, Florida. Biopsy sampling was conducted in 1998 and 2002 for contaminant analyses (Fair *et al.* 2003). Sub-samples were later used for genetic analysis which revealed significant genetic differentiation between Florida Bay and Biscayne Bay to the northeast (Litz *et al.* 2012). There is insufficient information to determine whether the Florida Bay stock comprises multiple demographically independent populations.

The Florida Bay resident stock of common bottlenose dolphins is considered to occur both within the bounds of Florida Bay and within the Gulf of Mexico-side portion of the Florida Keys National Marine Sanctuary (FKNMS) southwest to Marathon, Florida (Figure 1). The western boundary of the stock area follows the COLREGs line from Cape Sable in the north to the west side of Long Key in the south. The range of the resident animals is unknown. There is evidence that transient animals occur within the Florida Bay boundaries, including offshore morphotype animals that move onshore from nearby oceanic waters (Litz *et al.* 2012), although the frequency of this occurrence is unknown. The boundaries for the Florida Bay Stock are subject to change upon further study of dolphin home ranges within the Florida Bay estuarine system.

POPULATION SIZE

The total number of common bottlenose dolphins residing within the Florida Bay Stock is unknown (Table 1).

Earlier abundance estimates (>8 years old)

From November 1998 to June 2002, year-round surveys were conducted in Florida Bay, documenting 230 unique individuals (Engleby and Powell 2019). Torres (2007) conducted surveys of Florida Bay in the summers of 2002 through 2005 and documented 437 unique individuals. However, neither of these counts distinguished resident from non-resident animals in the Bay and so may be overestimates of the number of resident animals.

Minimum Population Estimate

No current information on abundance is available to calculate a minimum population estimate for the Florida Bay Stock of common bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Florida Bay Stock of common bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Florida Bay Stock of common bottlenose dolphins is undetermined.

Table 1. Best and minimum abundance estimates (Nest and Nmin) for the Florida Bay Stock of common bottlenose dolphins with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR

Unknown	-	Unknown	0.5	0.04	Undetermined

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Florida Bay Stock during 2016–2020 is unknown. The mean annual fishery-related mortality and serious injury during 2016–2020 based on strandings and at-sea observations identified as fishery-related was 0.2. No additional mortality or serious injury was documented from other human-caused sources. The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was therefore 0.2 (Table 2). This is considered a minimum because 1) not all fisheries that could interact with this stock are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network, especially in an area such as Florida Bay where human inhabitation of the shoreline is sparse (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, and 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016).

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Fishery Information

There are three commercial fisheries that interact, or that potentially could interact, with this stock. These include one Category II fishery (Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot) and two Category III fisheries (Florida spiny lobster trap/pot; and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line)). Detailed fishery information is presented in Appendix III.

Most of Florida Bay lies within the boundaries of the Everglades National Park with a smaller portion that lies within the FKNMS. Commercial fishing in the Everglades National Park is prohibited. The majority of recreational fishing is hook and line, although cast nets are also used.

Trap/Pot

During 2016–2020, there were two documented entanglement interactions of common bottlenose dolphins in Florida Bay associated with trap/pot fisheries. In 2017, one animal was disentangled from both commercial stone crab trap/pot gear and commercial spiny lobster trap/pot gear and released alive. In 2020, one animal was disentangled from commercial stone crab trap/pot gear and released alive. For both cases, it could not be determined (CBD) if the animals were seriously injured following mitigation efforts (the initial determinations were seriously injured for both (Maze-Foley and Garrison 2022). The two CBD cases were prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022) and are included in the annual human-caused mortality and serious injury total for this stock (Table 2), and were also documented within the stranding database (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021).

Since there is no observer program, it is not possible to estimate the total number of interactions or mortalities associated with these crab and lobster trap/pot fisheries. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Hook and Line (Rod and Reel)

During 2016–2020, there were no documented mortalities or serious injuries of common bottlenose dolphins involving hook and line gear entanglement or ingestion. The most recent documented interaction with this fishery was a serious injury that occurred in 2011. It is not possible to estimate the total number of interactions with hook and line gear because there is no observer program.

Other Mortality

There were no additional documented mortalities or serious injuries besides those described in the crab and lobster pots section above. All mortalities and serious injuries from known sources for the Florida Bay Stock are summarized in Table 2.

*Table 2. Summary of the incidental mortality and serious injury of common bottlenose dolphins (***Tursiops truncatus***) of the Florida Bay Stock. The fisheries do not have an ongoing, federal observer program, so counts of mortality and serious injury were based on stranding data, at-sea observations, or fisherman self-reported takes via the Marine Mammal Authorization Program (MMAP). For strandings, at-sea counts, and fisherman self-reported takes, the number reported is a minimum because not all strandings, at-sea cases, or gear interactions are detected. See the Annual Human-Caused Mortality and Serious Injury section for biases and limitations of mortality estimates, and the Strandings section for limitations of stranding data. NA = not applicable. *Indicates the count would have been higher had it not been for mitigation efforts (see text for that specific fishery for further details).*

Fishery	**Years**	**Data Type**	**Mean Annual Estimated Mortality and Serious Injury Based on Observer Data**	**5-year Minimum Count Based on Stranding, At-Sea, and/or MMAP Data**
Commercial Stone Crab and Commercial Spiny Lobster Trap/Pot (both gear types)	2016–2020	Stranding Data and At-Sea Observations	NA	0.5*[a]
Commercial Stone Crab Trap/Pot	2016–2020	Stranding Data and At-Sea Observations	NA	0.5*[a]
Hook and Line	2016–2020	Stranding Data and At-Sea Observations	NA	0
Mean Annual Mortality due to commercial fisheries (2016–2020)			**0.2**	
Mean Annual Mortality due to other takes (2016–2020)			**0**	
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)			**0.2**	

a. Includes one case of CBD which was prorated based on previous assignable injury events (NMFS 2012; Maze-Foley and Garrison 2022). There was one non-calf entanglement in which the post-mitigation determination was CBD. The CBD was prorated as 0.46 serious injury (rounded to 0.5).

Strandings

During 2016–2020, 14 common bottlenose dolphins were reported stranded within the boundaries of the Florida Bay Stock (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). Evidence of human interaction was found for two animals. For the remaining 12 animals, it could not be determined if there was evidence of human interactions. The two human interactions were from entanglements with trap/pot gear as described above. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death. However, for any case for which it could be determined that a human interaction contributed to an animal's stranding, serious injury, or death, the case was included in the counts of mortality and serious injury in Table 2.

The majority of stranding reports came from the portion of Florida Bay contained within the FKNMS, likely associated with the higher human population in this area and thus, a higher likelihood of a stranding being discovered and reported. Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al.* 2012; Wells *et al.* 2015; Carretta *et al.* 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement, or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al.* 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

Table 3. Common bottlenose dolphin strandings occurring in the Florida Bay Stock area from 2016 to 2020, including the number of strandings for which evidence of human interaction (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of HI. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 15 June 2021). Please note HI does not necessarily mean the interaction caused the animal's death.

Stock	Category	2016	2017	2018	2019	2020	Total
Florida Bay Stock	Total Stranded	4	2	2	4	2	14
	HI--Yes	0	1[a]	0	0	1[b]	2
	HI--No	0	0	0	0	0	0
	HI--CBD	4	1	2	4	1	12

a. An entanglement interaction with commercial stone crab and commercial spiny lobster trap/pot gear (released alive, CBD if seriously injured).

b. An entanglement interaction with commercial stone crab trap/pot gear (released alive, CBD if seriously injured).

HABITAT ISSUES

Over the past several decades, large areas of the Everglades ecosystem have been significantly altered by engineered flood control and water distribution for urban and agricultural development. These alterations of freshwater flow into Florida Bay have resulted in increased algal blooms, mangrove and seagrass die-offs, trophic community shifts and changes in salinity. In response, multiple federal, state, county and local agencies are working on a Comprehensive Everglades Restoration Program with the objective of restoring the natural flows of water, water quality and more natural hydro-periods within the ecosystem. As one of the largest ecosystem restoration efforts in the United States, projects are on-going and will likely impact physical and biotic parameters in Florida Bay. While it is unknown how alterations in water flow historically affected common bottlenose dolphin abundance and distribution, it is known that common bottlenose dolphins are a good indicator species to monitor the future health of this ecosystem due to the overlap between dolphin foraging behavior and abundant fish populations (see Torres and Urban 2005).

There is some concern about the potential effect of contaminants on the health of common bottlenose dolphins in Florida Bay, due to their proximity to large agricultural and industrial operations. Contaminants of concern include persistent organic pollutants and heavy metals such as mercury. The agricultural pesticide endosulfan is of particular concern, with the majority (76%) of endosulfan used in the southeast discharging into the Everglades and Florida Bay watershed (Pait *et al.* 1992). A study in 2003 collected remote biopsy samples and provided the first baseline data on levels of exposure to toxic persistent organic contaminants for dolphins in Florida Bay. Pesticides such as endosulfan were found at low or non-detectable concentrations (Fair *et al.* 2003). A review of available organochlorine exposure data from both dart biopsy and live-capture health assessment studies along the southeast U.S. coast indicate that contaminant levels were lowest for dolphins sampled in Florida Bay when compared to all other sites in the southeast U.S. Measured concentrations of total DDTs were lowest for dolphins sampled in Florida Bay. Reported total PCB concentrations were also lowest in Florida Bay and this was the only location in the southeast where samples fell below the toxic threshold value for total PCBs (Schwacke *et al.* 2004). Damseaux *et al.* (2017) confirmed persistent organic pollutant levels in common bottlenose dolphins from the Florida Coastal Everglades (FCE) were low compared to other populations of common bottlenose dolphins in the southeast U.S. However, the total mercury concentrations from male dolphins in the FCE were higher than other locations in Florida, such as the Florida Keys, Sarasota Bay, and the Indian River Lagoon (Damseaux *et al.* 2017). Although the effects of mercury on dolphins are unknown (see Kershaw and Hall 2019 for a review), high mercury concentrations from the FCE including Florida Bay raise concerns about potential health impacts on common bottlenose dolphins (Damseaux *et al*. 2017). There are no estimates of indirect human-caused mortality from pollution or habitat degradation.

STATUS OF STOCK

Common bottlenose dolphins in the northern Gulf of Mexico are not listed as threatened or endangered under the Endangered Species Act, and the Florida Bay Stock is not considered strategic under the MMPA. The documented mean annual human-caused mortality for this stock for 2016–2020 was 0.2. However, it is likely the estimate of annual human-caused, including fishery-caused, mortality and serious injury is biased low as indicated above (see Annual Human-Caused Mortality and Serious Injury section). Wells *et al.* (2015) estimated that the proportion of common bottlenose dolphin carcasses recovered in Sarasota Bay, a relatively open and more urbanized estuarine environment, was 0.33, indicating significantly more mortalities occur than are recovered. For a less developed area consisting of a more complex salt marsh habitat, the Barataria Bay Estuarine System, the estimated proportion of common bottlenose dolphin carcasses recovered was 0.16 (DWH MMIQT 2015). The Barataria Bay recovery rate may be most appropriate for this stock given it is a less developed area with a complex habitat. When annual human-caused mortality and serious injury is corrected for unrecovered carcasses using the 0.16 recovery rate (n=1.3), it does not exceed the previous PBR for this stock based on a minimum abundance estimate of 447. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to optimum sustainable population is unknown. There are insufficient data to determine the population trends for this stock.

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RICE'S WHALE (*Balaenoptera ricei*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Rice's whales are medium-sized baleen whales closely related to Bryde's whales and sei whales (Rosel and Wilcox 2014; Rosel *et al.* 2021). Rice's whales were identified as a unique evolutionary lineage and given species status in 2021 (Rosel *et al.* 2021). The species has a relatively restricted range within the northern Gulf of Mexico, although further research is ongoing to evaluate other potentially suitable habitat in the western and southern Gulf of Mexico. Sighting records and acoustic detections of Rice's whales in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur primarily in the northeastern Gulf in the De Soto Canyon area, along the continental shelf break between 100 m and 400 m depth, with a single sighting at 408 m (Figure 1; Hansen *et al.* 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006; Rice *et al.* 2014; Rosel and Wilcox 2014; Širović *et al.* 2014; Rosel *et al*. 2016; Soldevilla *et al.* 2017). Rice's whales have been sighted in all seasons within the De Soto Canyon area (Mullin and Hoggard 2000; Maze-Foley and Mullin 2006; Mullin 2007; DWH MMIQT 2015). Two strandings from the southeastern U.S. Atlantic coast share the same genetic characteristics with those from the northern Gulf of Mexico (Rosel and Wilcox 2014), but it is unclear whether these are extralimital strays (Mead 1977) or whether they indicate the population extends from the northeastern Gulf of Mexico to the Atlantic coast of the southern U.S. (Rosel and Wilcox 2014). There have been no confirmed sightings of Rice's whales along the U.S. east coast during NMFS cetacean surveys (Rosel *et al*. 2016; Rosel *et al.* 2021).

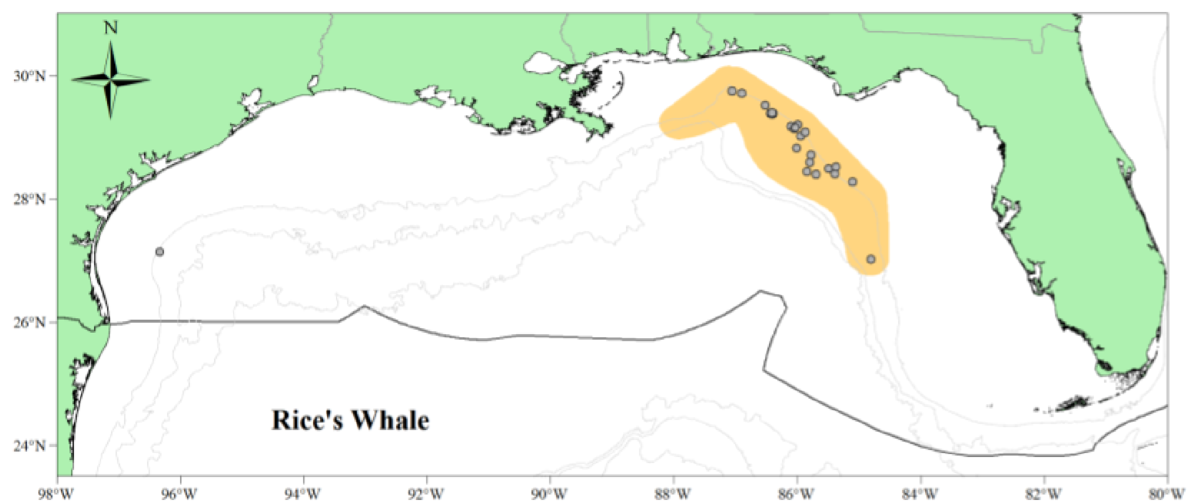

Figure 1. Distribution of all Rice's whale sightings from SEFSC vessel surveys during spring 1996–2001, summer 2003, spring 2004, summer 2009, summer 2017, and summer/fall 2018. Isobaths are the 200-m, 1,000-m, and 2,000-m depth contours. The darker line indicates the U.S. EEZ. The shaded area indicates the core habitat.

Historical whaling records from the 1800s suggest that Rice's whales may have been more common in the U.S. waters of the north central Gulf of Mexico and in the southern Gulf of Mexico in the Bay of Campeche (Reeves *et al.* 2011). Limited information exists on how regularly they currently use U.S. waters of the western Gulf of Mexico. There has been only one genetically confirmed sighting of a Rice's whale in this region, a whale observed during a 2017 NMFS vessel survey off Texas (Garrison *et al.* 2020; Rosel et al. 2021), despite substantial NMFS survey effort in the north central and western Gulf dating back to the early 1990s (e.g., Hansen et al. 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Rice's whale calls were present on up to 16% of days per site during one year of acoustic recordings at three sites along the north-central and northwestern Gulf shelf break, indicating some whales persistently occur in waters beyond the core habitat (Soldevilla *et al.* 2022a). Whether these whales represent a separate population from those in the northeastern Gulf, or are animals that utilize a broader range than just the northeastern Gulf, bears further study. A compilation of available records of cetacean sightings, strandings, and captures in Mexican waters of the southern Gulf of Mexico identified no Rice's whales (Ortega-Ortiz 2002). Additional work to evaluate the presence and abundance of this species in the western and southern Gulf of Mexico will further understanding of their distribution and the plausibility of additional demographically independent populations.

POPULATION SIZE

The best abundance estimate available for Rice's whales in the northern Gulf of Mexico is 51 (CV=0.50; Table 1). This estimate is from summer 2017 and summer/fall 2018 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. EEZ (Garrison *et al.* 2020).

Earlier abundance estimates

Five point estimates of Rice's whale abundance have been made based on data from surveys during: 2003 (June−August), 2004 (April−June), 2009 (July−August), 2017 (July−August), and 2018 (August−October). Each of these surveys had a similar design and was conducted using the same vessel or a vessel with a similar observation platform. Surveys in 2003, 2004, and 2009 employed a single survey team while the 2017 and 2018 surveys employed two survey teams. In addition, the 2017 and 2018 surveys were conducted in "passing" mode rather than "closing" mode. Passing mode eliminates the problems of fragmented tracklines associated with using closing mode in areas with high densities of animals. When using the closing mode with the two-team method, both teams must be allowed the opportunity to see a mammal group and allow it to pass behind the ship before turning to close on it, making it difficult to reacquire the group and resulting in long periods spent chasing the group, with the increased potential for off-effort sightings. For passive acoustics, in closing mode the vessel often turns before the acoustic team is able to achieve a good localization. This is especially important for deep-diving species where visual surveys are less optimal for abundance estimates. However, passing mode can result in increased numbers of unidentified sightings and may have affected group size estimation for distant groups of dolphins and small whales. Comparisons of the survey results over the years 2003 through 2009 required adjustments for these differences, including apportioning unidentified species among identified taxa to address the first issue, applying the model for detection probability on the trackline from the summer 2017 survey to the abundance estimates from the 2003, 2004, and 2009 surveys, and examining relationships between sighting distance and estimated group size (Garrison *et al.* 2020). This resulted in revised abundance estimates of 2003, N=0 (CV=NA); 2004, N=64 (CV=0.88); and 2009, N=100 (CV=1.03).

Recent surveys and abundance estimates

An abundance estimate for Rice's whales was generated from vessel surveys conducted in the northern Gulf of Mexico from the continental shelf edge (~200-m isobath) to the seaward extent of the U.S. EEZ (Garrison *et al.* 2020). One survey was conducted from 2 July to 25 August 2017 and consisted of 7,302 km of on-effort trackline, and the second survey was conducted from 11 August to 6 October 2018 and consisted of 6,473 km of on-effort trackline. The surveys were conducted in passing mode (e.g., Schwarz *et al.* 2010) while all prior surveys in the Gulf of Mexico have been conducted in closing mode. Both surveys used a double-platform data-collection procedure to allow estimation of the detection probability on the trackline using the independent observer approach assuming point independence (Laake and Borchers 2004). Due to the restricted habitat range of Rice's whales, survey effort was re-stratified to include only effort within their core habitat area (Figure 1; https://www.fisheries.noaa.gov/resource/map/gulf-mexico-brydes-whale-core-distribution-area-map-gis-data) including 941 km of effort in 2017 and 848 km of effort in 2018. In addition, there was an insufficient number of Rice's whale sightings during these surveys to develop an appropriate detection probability function. Therefore, a detection function was derived based on 91 sightings of Rice's whale groups observed during SEFSC large-vessel surveys between 2003 and 2019. The abundance estimates include unidentified large whales and baleen whales observed within the Rice's whale habitat. However, the estimate does not include the sighting of a confirmed Rice's whale in the western Gulf of Mexico in 2017. It is not possible to extrapolate estimated density beyond the core area since little is known about habitat use and distribution outside of this area. Estimates of abundance were derived using MCDS distance sampling methods that account for the effects of covariates (e.g., sea state, glare) on detection probability within the surveyed strip (Thomas *et al.* 2010) implemented in package mrds (version 2.21, Laake *et al.* 2020) in the R statistical programming language. The 2017 and 2018 estimates were N=84 (CV=0.92) and N=40 (CV=0.55), respectively. The inverse variance weighted mean calculation resulted in a best abundance estimate for Rice's whales in oceanic waters during 2017 and 2018 of 51 (CV=0.50;

Table 1; Garrison *et al.* 2020). This estimate was not corrected for the probability of detection on the trackline because there was only one resighting and few sightings overall of Rice's whales during the two-team surveys.

Table 1. Best abundance estimate (Nest) and coefficient of variation (CV) of Rice's whales in northern Gulf of Mexico oceanic waters (200 m to the offshore extent of the EEZ) based on the inverse variance weighted mean from summer 2017 and summer/fall 2018 vessel surveys.

Years	Area	Nest	CV Nest
2017, 2018	Gulf of Mexico	51	0.50

Minimum Population Estimate

The minimum population estimate (Nmin) is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Rice's whales is 51 (CV=0.50). The minimum population estimate for the northern Gulf of Mexico Rice's whale is 34 (Table 2).

Current Population Trend

Using revised abundance estimates for surveys conducted in 2003 (June−August), 2004 (April−June), and 2009 (July−August) (see above), and the 2017 (July−August) and 2018 (August−October) estimates, pairwise comparisons of the non-zero log-transformed means were conducted between years, and significant differences were assessed at alpha=0.10. P-values were adjusted for multiple comparisons. There were no significant differences in between survey years when whales were observed (Garrison *et al.* 2020).

However, the statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long intervals between surveys. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV>0.30) remains below 80% (alpha=0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). In addition, because these surveys are restricted to U.S. waters, it is not possible to distinguish between changes in population size and Gulf-wide shifts in spatial distribution.

All verified Rice's whale sightings, with one exception, have occurred in a very restricted area of the northeastern Gulf (Figure 1) during surveys that uniformly sampled the entire oceanic northern Gulf. Because the population size is small, in order to effectively monitor trends in Rice's whale abundance in the future, other methods need to be used.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations likely do not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995). Between 1988 and 2018, there have been two documented strandings of calves (total length <700 cm) in the northern Gulf of Mexico (SEUS Historical Stranding Database unpublished data; NOAA National Marine Mammal Health and Stranding Response Database unpublished data).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997; Wade 1998). The minimum population size is 34. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.1 because the stock is listed as endangered. PBR for the northern Gulf of Mexico Rice's whale stock is 0.07 (Table 2; value is 0.068 before rounding (NMFS 2016)).

Table 2. Best and minimum abundance estimates for northern Gulf of Mexico Rice's whales with Maximum Productivity Rate (Rmax), Recovery Factor (Fr) and PBR.

Nest	CV Nest	Nmin	Fr	Rmax	PBR
51	0.50	34	0.1	0.04	0.07

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual estimated fishery-related mortality and serious injury for the northern Gulf of Mexico Rice's whale stock during 2016–2020 is unknown. There was no documented fishery-caused mortality or serious injury for this stock during 2016–2020 (Table 3). Mean annual mortality and serious injury during 2016–2020 due to other human-caused actions (the *Deepwater Horizon* oil spill, ingested plastic) was predicted to be 0.5 (Appendix VI). The minimum total mean annual human-caused mortality and serious injury for this stock during 2016–2020 was, therefore, 0.5. This is considered a minimum mortality estimate as some fisheries with which the stock could interact have limited observer coverage. In addition, the likelihood is low that a whale killed at sea due to a fishery interaction or vessel-strike will be recovered (Williams *et al.* 2011).

Table 3. Total annual estimated fishery-related mortality and serious injury for northern Gulf of Mexico Rice's whales.

Years	Source	Annual Avg.	CV
2016–2020	U.S. fisheries using observer data	Unknown	-

Fisheries Information

There are three commercial fisheries that overlap geographically and potentially could interact with this stock in the Gulf of Mexico. These include the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagics longline fishery, and two Category III fisheries, the Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline/hook-and-line fishery and the Southeastern U.S. Atlantic, Gulf of Mexico, and Caribbean snapper-grouper and other reef fish bottom longline/hook-and-line fishery. See Appendix III for detailed fishery information. All three of these fisheries have observer programs, however observer coverage is limited for the two Category III fisheries.

Pelagic swordfish, tunas, and billfish are the targets of the large pelagics longline fishery operating in the northern Gulf of Mexico. During 2016–2020 there were no observed mortalities or serious injuries to Rice's whales by this fishery (Garrison and Stokes 2019; 2020a; 2020b; 2021; 2023). Percent observer coverage (percentage of sets observed) for this longline fishery for each year during 2016–2020 was 23, 13, 20, 13, and 6.3, respectively. For the two category III bottom longline/hook-and-line fisheries, the target species are large and small coastal sharks and reef fishes such as snapper, grouper, and tilefish. There has been no reported fishery-related mortality or serious injury of a Rice's whale by either of these fisheries (e.g., Scott-Denton *et al.* 2011; Gulak *et al.* 2013; 2014; Enzenauer *et al.* 2015; 2016; Mathers *et al.* 2017; 2018; 2020a,b). Within the Gulf of Mexico, observer coverage for the snapper-grouper and other reef fish bottom longline fishery is ~1% or less annually, and for the shark bottom longline fishery coverage is 1–2% annually. Usually bottom longline gear is thought to pose less of a risk for cetaceans to become entangled than pelagic longline gear. However, if cetaceans forage along the seafloor, as is suspected for the Rice's whale (Soldevilla *et al.* 2017), then there is an opportunity for these whales to become entangled in the mainline as well as in the vertical buoy lines (Rosel *et al.* 2016).

Two other commercial fisheries that overlap to a small degree with the primary Rice's whale habitat in the northeastern Gulf of Mexico are the Category III Gulf of Mexico butterfish trawl fishery and Category II Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery (Rosel *et al.* 2016). No interactions with Rice's whales have been documented for either of these fisheries. There is no observer coverage for the butterfish trawl fishery. The shrimp trawl fishery has ~2% observer coverage annually.

Other Mortality

There was one reported stranding of a Rice's whale in the Gulf of Mexico during 2016–2020 (Henry et al. 2022; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 15 June 2021). One whale stranded in 2019, and there was evidence of human interaction in the form of a hard, sharp piece of ingested plastic. The plastic ingestion was believed to contribute to the stranding and ultimate death of the animal (Rosel *et al.* 2021).

Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the whales that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier *et al*. 2012; Wells *et al*. 2015; Carretta et al. 2016). In particular, oceanic stocks in the Gulf of Mexico are less likely to strand than nearshore coastal stocks or shelf stocks (Williams *et al.* 2011). Additionally, not all carcasses will show evidence of human interaction, entanglement or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd *et al*. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 March 2010 and ending 31 July 2014 (Litz *et al.* 2014; http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 1 June 2016). It included cetaceans that stranded prior to the *Deepwater Horizon* (DWH) oil spill (see "Habitat Issues" below), during the spill, and after. Exposure to the DWH oil spill was determined to be the primary underlying cause of the elevated stranding numbers in the northern Gulf of Mexico after the spill (e.g., Schwacke *et al.* 2014; Venn-Watson *et al.* 2015; Colegrove *et al.* 2016; DWH NRDAT 2016; see Habitat Issues section). Two Rice's whale strandings in 2012 were considered to be part of this UME.

A population model was developed to estimate the injury and time to recovery for stocks affected by the DWH oil spill, taking into account long-term effects resulting from mortality, reproductive failure, reduced survival rates, and the proportion of the stock exposed to DWH oil (DWH MMIQT 2015). Based on the population model, it was projected that 1.4 Rice's whales died during 2016–2020 (see Appendix VI) due to elevated mortality associated with oil exposure and that the stock experienced a 22% maximum reduction in population size due to the oil spill (DWH MMIQT 2015). The DWH Marine Mammal Injury Quantification Team cautioned that the capability of Rice's whales to recover from the DWH oil spill is unknown because the population models do not account for stochastic processes and genetic effects (DWH MMIQT 2015), to which small populations are highly susceptible (Shaffer 1981; Rosel and Reeves 2000). The population model used to predict Rice's whale mortality due to the DWH event has a number of sources of uncertainty. Model parameters (e.g., survival rates, reproductive rates, and life-history parameters) were derived from literature sources for Rice's whales occupying waters outside of the Gulf of Mexico. In addition, proxy values for the effects of DWH oil exposure on both survival rates and reproductive success were applied based upon estimated values for common bottlenose dolphins in Barataria Bay. Finally, there was no estimation of uncertainty in model parameters or outputs.

It should be noted that vessel strikes also pose a threat to this stock (Soldevilla *et al.* 2017), although none were observed or documented during the 2016–2020 time period covered by this report. In 2009, a Rice's whale was found floating in the Port of Tampa, Tampa Bay, Florida. The whale had evidence of pre-mortem and post-mortem blunt trauma, and was determined to have been struck by a vessel, draped across the bow, and carried into port. In addition, Rosel et al. (2021) reported a 2019 sighting of a free-swimming Rice's whale with a spinal deformation consistent with a vessel strike at some point in the past.

All mortalities and serious injuries during 2016–2020 from known sources for Rice's whales are summarized in Table 4.

Table 4. Summary of the incidental mortality and serious injury of Rice's whales during 2016–2020 from all sources.

Mean Annual Mortality due to commercial fisheries (2016–2020, Table 3)	Unknown
Mean Annual Mortality due to the DWH oil spill (2016–2020, Appendix VI)	0.3
Mean Annual Mortality due to Other Human-Caused Sources (ingested plastic) (2016–2020)	0.2
Minimum Total Mean Annual Human-Caused Mortality and Serious Injury (2016–2020)	**0.5**

HABITAT ISSUES

The *DWH* MC252 drilling platform, located approximately 80 km southeast of the Mississippi River Delta in waters about 1,500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days ~3.2 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (DWH NRDAT 2016). Shortly after the oil spill, the NRDA process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies were conducted to determine potential impacts of the spill on marine mammals. These studies estimated that 48% of Rice's whales in the Gulf were exposed to oil, that 22% (95% CI: 10–31) of females suffered from reproductive failure, and 18% (95% CI: 7–28) of the population suffered adverse health effects (DWH MMIQT 2015). A population model estimated the stock experienced a maximum 22% reduction in population size (see Other Mortality section above).

Anthropogenic sound in the world's oceans has been shown to affect marine mammals, with vessel traffic, seismic surveys, and active naval sonars being the main anthropogenic contributors to low- and mid-frequency noise in oceanic waters (e.g., Nowacek *et al.* 2015; Gomez *et al.* 2016; NMFS 2018). The long-term and population consequences of these impacts are less well-documented and likely vary by species and other factors. Impacts on marine mammal prey from sound are also possible (Carroll *et al.* 2017), but the duration and severity of any such prey effects on marine mammals are unknown. Anecdotal evidence indicated Rice's whales temporarily stopped calling when approached by a research vessel (Soldevilla *et al.* 2022b), and this suggests disturbance from vessel noise and activity may be a management concern for this small stock.

New industries including aquaculture and wind energy development are actively being pursued in the Gulf of Mexico, which may have complex and adverse interactions with Rice's whales if development occurs within or near their habitat. The Gulf of Mexico has been chosen as one of the first areas for aquaculture development under the U.S. Presidential Executive Order 13921 (May 7, 2020) calling for the expansion of sustainable seafood production in the U.S. Potential impacts can occur at all stages of aquaculture development, operation, and decommissioning and can include attraction to farms or displacement from important habitats, resulting in changes to distribution, behaviors, or social structures (Clement 2013; Price *et al.* 2017; Heinrich *et al.* 2019). Physical interactions with gear (entanglement) or vessels can also result in injuries or mortalities (Price *et al.* 2017; Callier *et al.* 2018). For example, two Bryde's whale mortalities occurred in New Zealand due to entanglement in mussel farm spat lines (Baker *et al.* 2010). Possible indirect effects include noise or light pollution, habitat degradation, harmful algal blooms, or disease outbreaks (Clement 2013; Heinrich *et al.* 2019). Wind energy development has the potential to affect Rice's whales and/or their prey during pre-construction, construction, operation, and decommissioning through increased underwater sound and vibrations, vessel strikes, habitat alteration, chemical pollution, and entanglement (Rolland *et al.* 2012; Bailey *et al.* 2014; Taormina *et al.* 2018; Farr *et al.* 2021; Popper *et al.* 2022).

STATUS OF STOCK

The Rice's whale is listed as endangered under the Endangered Species Act, and therefore the northern Gulf of Mexico stock is considered strategic under the MMPA. The stock is very small and exhibits very low genetic diversity (Rosel and Wilcox 2014; Rosel *et al.* 2021), which places the stock at great risk of demographic stochasticity. The stock's restricted range also places it at risk of environmental stochasticity. In addition, the mean annual human-caused mortality and serious injury exceeds PBR for this stock. The status of Rice's whales in the northern Gulf of Mexico, relative to optimum sustainable population, is unknown. There was no statistically significant trend in population size for this stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Bay, Sound, and Estuary Stocks

NOTES – This SAR has not been revised. A technical update has been made to move Florida Bay from the Western North Atlantic to the Gulf of Mexico. Florida Bay is now included in Table 1 and Figure 1, and the #s of stocks have been updated accordingly. No other updates have been made.

NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound, and estuary stocks of common bottlenose dolphins in the northern Gulf of Mexico. To date, nine stocks have individual reports completed or drafted (West Bay, Galveston Bay/East Bay/Trinity Bay, Terrebonne-Timbalier Bay Estuarine System, Barataria Bay Estuarine System, Mississippi Sound/Lake Borgne/Bay Boudreau, Choctawhatchee Bay, St. Andrew Bay, St. Joseph Bay, and Florida Bay), and the remaining 23 stocks are assessed in this report.

STOCK DEFINITION AND GEOGRAPHIC RANGE

Common bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). The identification of demographically independent populations of common bottlenose dolphins in these waters is complicated by the high degree of behavioral variability exhibited by this species (Shane *et al.* 1986; Wells and Scott 1999; Wells 2003), and by the lack of requisite information for much of the region.

Distinct stocks are delineated in each of 32 areas of contiguous, enclosed or semi-enclosed bodies of water adjacent to the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico; Table 1; Figure 1). The genesis of the delineation of these stocks was work initiated in the 1970s in Sarasota Bay, Florida (Irvine and Wells 1972; Irvine *et al.* 1981), and in bays in Texas (Shane 1977; Gruber 1981). These studies documented year-round residency of individual common bottlenose dolphins in estuarine waters. As a result, the expectation of year-round resident populations was extended to bay, sound and estuary (BSE) waters across the northern Gulf of Mexico when the first stock assessment reports were published in 1995 (Blaylock *et al.* 1995). Since these early studies, long-term (year-round, multi-year) residency has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico. In Texas, long-term resident dolphins have been reported in the Matagorda-Espiritu Santo Bay area (Gruber 1981; Lynn and Würsig 2002), Aransas Pass (Shane 1977; Weller 1998), San Luis Pass (Maze and Würsig 1999; Irwin and Würsig 2004), and Galveston Bay (Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Fazioli and Mintzer 2020). In Louisiana, Miller (2003) concluded the common bottlenose dolphin population in the Barataria Basin was relatively closed, and Wells *et al.* (2017) documented long-term, year-round residency in Barataria Bay based on telemetry data. Hubard *et al.* (2004) reported sightings of dolphins in Mississippi Sound that were known from tagging efforts there 12–15 years prior; long-term residency was further documented by Mullin *et al*. (2017). In Florida, long-term residency has been reported from Tampa Bay (Wells 1986; Wells *et al.* 1996b; Urian *et al.* 2009), Sarasota Bay (Irvine and Wells 1972; Irvine *et al.* 1981; Wells 1986; 1991; 2003; 2014; Wells *et al.* 1987; Scott *et al.* 1990), Lemon Bay (Wells *et al.* 1996a; Bassos-Hull *et al.* 2013), Charlotte Harbor/Pine Island Sound (Shane 1990; Wells *et al.* 1996a; 1997; Shane 2004; Bassos-Hull *et al.* 2013) and Gasparilla Sound (Bassos-Hull *et al.* 2013). In Sarasota Bay, which has the longest research history, up to five concurrent generations of identifiable residents have been identified, including individuals identified through more than four decades (Wells 2014). Maximum immigration and emigration rates of about 2–3% have been estimated (Wells and Scott 1990).

Genetic data also support the concept of relatively discrete BSE stocks. Analyses of mitochondrial DNA haplotype distributions indicate the existence of clinal variations along the Gulf of Mexico coastline (Duffield and Wells 2002). Differences in reproductive seasonality from site to site also suggest genetic-based distinctions between communities (Urian et al. 1996). Mitochondrial DNA analyses suggest finer-scale structural levels as well. For example, dolphins in Matagorda Bay, Texas, appear to be a localized population, and differences in haplotype frequencies distinguish among adjacent communities in Tampa Bay, Sarasota Bay, and Charlotte Harbor/Pine Island Sound, along the central west coast of Florida (Duffield and Wells 1991; 2002). Additionally, Sellas *et al.* (2005) examined population subdivision among dolphins sampled in Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, and the coastal Gulf of Mexico (1–12 km offshore) from just outside Tampa Bay to the southern end of Lemon

Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and nine nuclear microsatellite loci. Rosel *et al.* (2017) also identified significant population differentiation between estuarine residents of Barataria Bay and the adjacent coastal stock. The Sellas *et al.* (2005) and Rosel *et al.* (2017) findings support the separate identification of BSE populations from those occurring in adjacent Gulf coastal waters.

In many cases, residents occur primarily in BSE waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; 1990; Gruber 1981; Irvine *et al.* 1981; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). These habitat use patterns are reflected in the ecology of the dolphins in some areas; for example, residents of Sarasota Bay, Florida, lacked squid in their diet, unlike non-resident dolphins stranded on nearby Gulf beaches (Barros and Wells 1998). However, in some areas year-round residents may co-occur with non-resident dolphins. For example, about 14–17% of group sightings involving resident Sarasota Bay dolphins include at least one non-resident as well (Wells *et al.* 1987; Fazioli *et al.* 2006). Mixing of inshore residents and non-residents has been seen at San Luis Pass, Texas (Maze and Würsig 1999), Cedar Keys, Florida (Quintana-Rizzo and Wells 2001), and Pine Island Sound, Florida (Shane 2004). Non-residents exhibit a variety of movement patterns, ranging from apparent nomadism recorded as transience to a given area, to apparent seasonal or non-seasonal migrations. Passes, especially the mouths of the larger estuaries, serve as mixing areas. For example, dolphins from several different areas were documented at the mouth of Tampa Bay, Florida (Wells 1986), and most of the dolphins identified in the mouths of Galveston Bay and Aransas Pass, Texas, were considered transients (Henningsen 1991; Bräger 1993; Weller 1998).

Seasonal movements of dolphins into and out of some of the bays, sounds and estuaries have also been documented. In Sarasota Bay, Florida, and San Luis Pass, Texas, residents have been documented using Gulf coastal waters more frequently in fall/winter, and inshore waters more in spring/summer (Irvine *et al.* 1981; Maze and Würsig 1999). Fall/winter increases in abundance have been noted for Tampa Bay (Scott *et al.* 1989) and are thought to occur in Matagorda Bay (Gruber 1981; Lynn and Würsig 2002) and Aransas Pass (Shane 1977; Weller 1998). Spring/summer increases in abundance occur in Mississippi Sound (Hubard *et al.* 2004) and are thought to occur in Galveston Bay (Henningsen 1991; Bräger 1993; Fertl 1994). However, Mullin *et al.* (2017) found that seasonal fluctuations in Mississippi Sound were less than previously reported.

Spring and fall increases in abundance have been reported for St. Joseph Bay, Florida. Mark-recapture abundance estimates were highest in spring and fall and lowest in summer and winter (Table 1; Balmer *et al.* 2008). Individuals with low site-fidelity indices were sighted more often in spring and fall, whereas individuals sighted during summer and winter displayed higher site-fidelity indices. In conjunction with health assessments, 23 dolphins were radio tagged during April 2005 and July 2006. Dolphins tagged in spring 2005 displayed variable utilization areas and variable site fidelity patterns. In contrast, during summer 2006 the majority of radio-tagged individuals displayed similar utilization areas and moderate to high site-fidelity patterns. The results of the studies suggest that during summer and winter St. Joseph Bay hosts dolphins that spend most of their time within this region, and these may represent a resident community. In spring and fall, St. Joseph Bay is visited by dolphins that range outside of this area (Balmer *et al.* 2008).

The current BSE stocks are delineated as described in Table 1. There are some estuarine areas that are not currently part of any stock's range. Many of these are areas that dolphins cannot readily access. For example, the marshlands between Galveston Bay and Sabine Lake and between Sabine Lake and Calcasieu Lake are fronted by long, sandy beaches that prohibit dolphins from entering the marshes. The region between the Calcasieu Lake and Vermilion Bay/Atchafalaya Bay stocks has some access, but these marshes are predominantly freshwater rather than saltwater marshes, making them unsuitable for long-term survival of a viable population of common bottlenose dolphins. In other regions, there is insufficient estuarine habitat to harbor a demographically independent population, for instance between the Matagorda Bay and West Bay Stocks in Texas, and/or sufficient isolation of the estuarine habitat from coastal waters. The regions between the south end of the Estero Bay Stock area to just south of Naples and between Little Sarasota Bay and Lemon Bay are highly developed and contain little appropriate habitat. South of Naples to Marco Island and Gullivan Bay is also not currently covered within a stock boundary. This region contains common bottlenose dolphins, but the relationship of any dolphins in this region to other BSE stocks is unknown. They may be members of the Gullivan to Chokoloskee Bay stock as there is passage behind Marco Island that would allow dolphins to move north. The regions between Apalachee Bay and Cedar Key/Waccasassa Bay, between Crystal Bay and St. Joseph Sound, and between Chokoloskee Bay and Whitewater Bay comprise thin strips of marshland with no barriers to adjacent coastal waters. Further work is necessary to determine whether year-round resident dolphins use these thin marshes or whether dolphins in these areas are members of the coastal stock that use the fringing marshland as well. Finally, the region between the eastern border of the Barataria Bay Estuarine System Stock and the Mississippi

River Delta Stock to the east may harbor dolphins, but the area is small and work is necessary to determine whether any dolphins utilizing this habitat come from an adjacent BSE stock.

As more information becomes available, combination or division of these stocks, or alterations to stock boundaries, may be warranted. For example, research based on photo-ID data collected by Bassos-Hull *et al.* (2013) recommended combining Lemon Bay with Gasparilla Sound/Charlotte Harbor/Pine Island Sound. Therefore, these stocks have been combined (see Table 1). However, it should be noted this change was made in the absence of genetic data and could be revised again in the future when genetic data are available. Additionally, a number of geographically and socially distinct subgroupings of dolphins in regions such as Tampa Bay, Charlotte Harbor, Pine Island Sound, Barataria Bay, Aransas Pass, and Matagorda Bay have been identified (Shane 1977; Gruber 1981; Wells *et al.* 1996a; 1996b; 1997; 2017; Lynn and Würsig 2002; Urian 2002; Rosel *et al.* 2017). For Tampa Bay, Urian *et al.* (2009) described five discrete communities (including the adjacent Sarasota Bay community) that differed in their social interactions and ranging patterns. Structure was found despite a lack of physiographic barriers to movement within this large, open embayment. Urian *et al.* (2009) further suggested that fine-scale structure may be a common element among common bottlenose dolphins in the southeastern U.S. and recommended that management should account for fine-scale structure that exists within current stock designations. These results indicate that it is plausible some of these estuarine stocks, particularly those in larger bays and estuaries, comprise multiple demographically-independent populations.

Table 1. Most recent common bottlenose dolphin abundance estimate (Nest), coefficient of variation of Nest (CV Nest), minimum population estimate (Nmin), Potential Biological Removal (PBR), year of the most recent abundance estimate and associated publication (Year), and minimum counts of annual human-caused mortality and serious injury (HCMSI) in northern Gulf of Mexico bay, sound and estuary stocks. When estimates are based on data collected more than eight years ago, they are considered unknown or undetermined for management purposes. Label number refers to estuary locations displayed in Figure 1.UNK – unknown; UND – undetermined. For each stock denoted with a † symbol, please refer to the stand-alone report for this stock.

Label Number	Gulf of Mexico Estuary	Nest	CV Nest	Nmin	PBR	Year (Reference)	Minimum Annual HCMSI, 2015–2019
1	Laguna Madre	80	1.57	UNK	UND	1992 (A)	0.8
2	Nueces Bay/Corpus Christi Bay	58	0.61	UNK	UND	1992 (A)	0.2
3	Copano Bay/Aransas Bay/San Antonio Bay/Redfish Bay/Espiritu Santo Bay	55	0.82	UNK	UND	1992 (A)	0.6
4	Matagorda Bay/Tres Palacios Bay/Lavaca Bay	61	0.45	UNK	UND	1992 (A)	0.4
5	West Bay†						
6	Galveston Bay/East Bay/Trinity Bay†						
7	Sabine Lake	122[a]	0.19	104	0.9	2017 (B)	0
8	Calcasieu Lake	0[b]	-	-	UND	1992 (A)	0.2

9	Vermilion Bay/West Cote Blanche Bay/Atchafalaya Bay	0[b]	-	-	UND	1992 (A)	0
10	Terrebonne-Timbalier Bay Estuarine System†						
11	Barataria Bay Estuarine System†						
12	Mississippi River Delta	1,446[c]	0.19	1,238	11	2017–2018 (C)	9.2
13	Mississippi Sound/Lake Borgne/Bay Boudreau†						
14	Mobile Bay/Bonsecour Bay	122	0.34	UNK	UND	1993 (A)	15.6
15	Perdido Bay	0[b]	-		UND	1993 (A)	0.6
16	Pensacola Bay/East Bay	33	0.80	UNK	UND	1993 (A)	0.4
17	Choctawhatchee Bay†						
18	St. Andrew Bay†						
19	St. Joseph Bay†						
20	St. Vincent Sound/Apalachicola Bay/St. George Sound	439	0.14	UNK	UND	2007 (D)	0.2
21	Apalachee Bay	491	0.39	UNK	UND	1993 (A)	0
22	Waccasassa Bay/Withlacoochee Bay/Crystal Bay	UNK	-	UNK	UND	-	0.4
23	St. Joseph Sound/Clearwater Harbor	UNK	-	UNK	UND	-	0.6[d]
24	Tampa Bay	UNK	-	UNK	UND	-	3.0
25	Sarasota Bay/Little Sarasota Bay	158	0.27	126	1.0	2015 (E)	0.2[e]
26	Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay	826	0.09	UNK	UND	2006 (F)	1.0[f]

27	Caloosahatchee River	0[b]	-	-	UND	1985 (G)	0.2[g]
28	Estero Bay	UNK	-	UNK	UND	-	0.2
29	Chokoloskee Bay/Ten Thousand Islands/Gullivan Bay	UNK	-	UNK	UND	-	0.2
30	Whitewater Bay	UNK	-	UNK	UND	-	0
31	Florida Bay†						
32	Florida Keys (southwest Marathon Key to Marquesas Keys)	UNK	-	UNK	UND	-	0

References: A – Blaylock and Hoggard 1994; B – Ronje et al. 2020; C – Garrison et al. 2021; D – Tyson *et al.* 2011; E – Tyson and Wells 2016; F – Bassos-Hull *et al.* 2013; G – Scott *et al.* 1989

Notes:
a. Winter seasonal estimate, Selective dataset.
b. During earlier surveys (Scott *et al.* 1989), the range of seasonal abundances was as follows: Calcasieu Lake, 0–6 (0.34); Vermilion Bay/West Cote Blanche Bay/Atchafalaya Bay, 0–0; Perdido Bay, 0–0; Lemon Bay, 0–15 (0.43); and Caloosahatchee River, 0–0.
c. Abundance estimate utilizes density estimate from adjacent waters. See Garrison *et al.* (2021) for details.
d. The minimum count would have been higher (1.0 instead of 0.6) had it not been for mitigation efforts.
e. The minimum count would have been higher (0.4 instead of 0.2) had it not been for mitigation efforts.
f. The minimum count would have been higher (1.4 instead of 1.0) had it not been for mitigation efforts.
g. The minimum count would have been higher (0.4 instead of 0.2) had it not been for mitigation efforts.

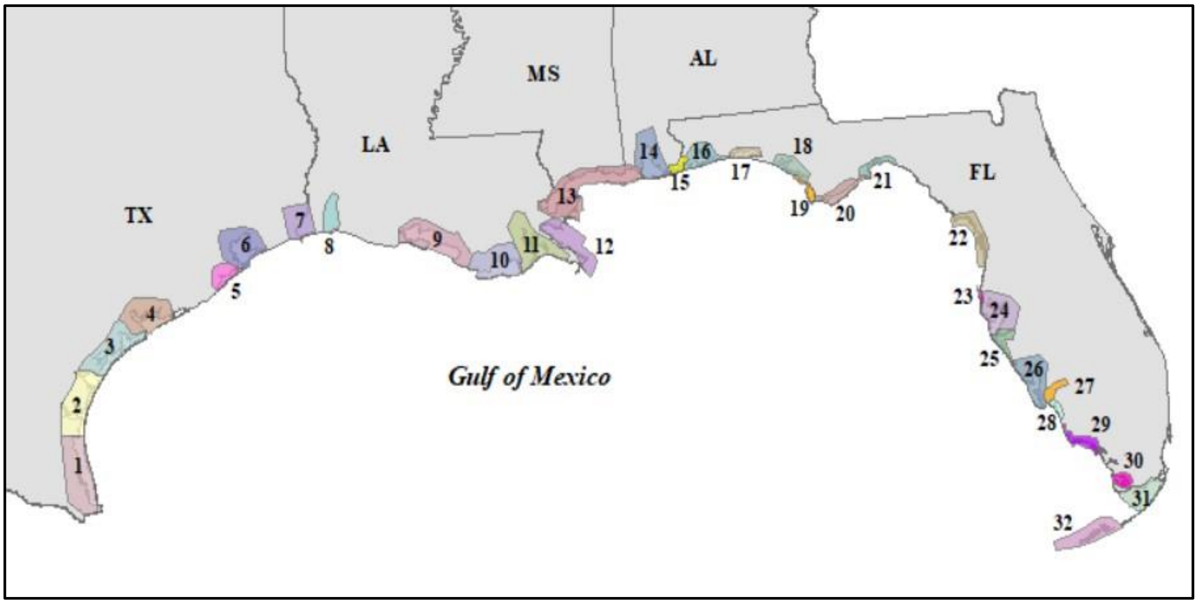

Figure 1. Northern Gulf of Mexico bays, sounds, and estuaries. Each of the numbers corresponds to one of the estuaries listed in Table 1. The common bottlenose dolphins inhabiting each bay, sound, or estuary are considered to comprise a unique stock for purposes of this assessment. Nine stocks have their own stock assessment report (see Table 1).

POPULATION SIZE

Population size estimates for most of these stocks are more than eight years old and therefore the current population sizes for all but three are considered unknown (Wade and Angliss 1997). However, a capture-mark-recapture population size estimate is available for Sarasota Bay/Little Sarasota Bay for 2015 (Tyson and Wells 2016) and Sabine Lake for 2017 (Ronje *et al.* 2020). Recent aerial survey line-transect population size estimates are available for Mississippi River Delta for 2017–2018 (Garrison *et al.* 2021; Table 1). Population size estimates for many stocks were generated from preliminary analyses of line-transect data collected during aerial surveys conducted in September–October 1992 in Texas and Louisiana and in September–October 1993 in Louisiana, Mississippi, Alabama, and the Florida Panhandle (Blaylock and Hoggard 1994; Table 1). Standard line-transect perpendicular sighting distance analytical methods (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) were used.

Minimum Population Estimate

The population sizes for all but three stocks are currently unknown and the minimum population estimates are given for those three stocks in Table 1. The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate was calculated for each block from the estimated population size and its associated coefficient of variation.

Current Population Trend

The data are insufficient to determine population trends for most of the Gulf of Mexico BSE common bottlenose dolphin stocks.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for these stocks. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (Wade and Angliss 1997). The recovery factor is 0.45 for Louisiana, Mississippi, and Alabama BSE stocks because the CV of the shrimp trawl mortality estimate for those stocks is greater than 0.6. The recovery factor is 0.4 for Texas and Florida BSE stocks because the CV of the shrimp trawl mortality estimate for those stocks is greater than 0.8 (Wade and Angliss 1997). PBR is undetermined for all but three stocks because the population size estimates are more than eight years old. PBR for those stocks with population size estimates less than eight years old is given in Table 1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for these stocks of common bottlenose dolphins during 2015–2019 is unknown. Minimum estimates of human-caused mortality and serious injury for each stock are given in Table 1. These estimates are considered a minimum because: 1) not all fisheries that could interact with these stocks are observed and/or observer coverage is very low, 2) stranding data are used as an indicator of fishery-related interactions and not all dead animals are recovered by the stranding network (Peltier *et al*. 2012; Wells *et al*. 2015), 3) cause of death is not (or cannot be) routinely determined for stranded carcasses, 4) the estimate of fishery-related interactions includes an actual count of verified fishery-caused deaths and serious injuries and should be considered a minimum (NMFS 2016), 5) the estimate does not include shrimp trawl bycatch because estimates are not available for individual BSE stocks (see Shrimp Trawl section), and 6) various assumptions were made in the population model used to estimate population decline for northern Gulf of Mexico BSE stocks impacted by the *Deepwater Horizon* (DWH) oil spill.

Fishery Information

There are seven commercial fisheries that interact, or that potentially could interact, with these stocks in the Gulf of Mexico. These include four Category II fisheries (Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl; Gulf of Mexico menhaden purse seine; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; and Gulf of Mexico gillnet fisheries); and three Category III fisheries (Gulf of Mexico blue crab trap/pot; Florida spiny lobster trap/pot; and Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel (hook and line) fisheries). Detailed fishery information is presented in Appendix III.

Note: Animals reported in the sections to follow were ascribed to a stock or stocks of origin following methods described in Maze-Foley et al. (2019). These include strandings, observed takes (through an observer program), fisherman self-reported takes (through the Marine Mammal Authorization Program), research takes, and opportunistic at-sea observations.

Shrimp Trawl

During 2015–2019, based on limited observer coverage in Louisiana BSE waters under the NMFS MARFIN program, there was one observed mortality and no observed serious injuries of common bottlenose dolphins from Gulf of Mexico BSE stocks by commercial shrimp trawls. Between 1997 and 2019, 13 common bottlenose dolphins and nine unidentified dolphins, which could have been either common bottlenose dolphins or Atlantic spotted dolphins, became entangled in the net, lazy line, turtle excluder device or tickler chain gear in the commercial shrimp trawl fishery in the Gulf of Mexico (Soldevilla *et al.* 2015; 2016; 2021). All dolphin bycatch interactions resulted in mortalities except for one unidentified dolphin that was released alive without serious injury in 2009 (Maze-Foley and Garrison 2016). Soldevilla *et al*. (2015; 2016; 2021) provided mortality estimates calculated from analysis of shrimp fishery effort data and NMFS's Observer Program bycatch data. Limited observer coverage in Louisiana BSE waters started in 2015, but has not yet reached sufficient levels for estimating BSE bycatch rates; therefore time-area stratified bycatch rates were extrapolated into inshore waters to estimate the most recent five-year unweighted mean mortality estimate for 2015–2019 based on inshore fishing effort (Soldevilla *et al.* 2021). The 4-area (Texas, Louisiana, Mississippi/Alabama, Florida) stratification method was chosen because it best approximates how fisheries operate (Soldevilla *et al*. 2015; 2016; 2021). The BSE stock mortality estimates were aggregated at the state area level as this was the spatial resolution at which fishery effort is modeled (e.g., Nance *et al.* 2008). The mean annual mortality estimates for the BSE stocks were as follows: Texas BSE (from Galveston Bay/East Bay/Trinity Bay south to Laguna

Madre):) 0.4 (CV=1.62); Louisiana BSE (from Sabine Lake east to Barataria Bay): 45 (CV=0.65); Mississippi/Alabama BSE (from Mississippi River Delta east to Mobile Bay/Bonsecour Bay): 33 (CV=0.70); and Florida BSE (from Perdido Bay east and south to the Florida Keys): 0.7 (CV=1.58). These estimates do not include skimmer trawl effort, which accounts for 61% of shrimp fishery effort in western Louisiana, and 38% of shrimp fishery effort in eastern Louisiana, Mississippi, and Alabama inshore waters, because observer program coverage of skimmer trawls is limited. Limitations and biases of annual bycatch mortality estimates are described in detail in Soldevilla *et al.* (2015; 2016; 2021). It should be noted that because bycatch for individual BSE stocks cannot be quantified at this time, shrimp trawl bycatch is not being included in the annual human-caused mortality and serious injury total for any BSE stock.

During 2015–2019, stranding data documented two mortalities of common bottlenose dolphins associated with entanglement in shrimp trawl gear. Both mortalities occurred in 2016—one in Pensacola Bay and one in Perdido Bay.

During 2016 the Marine Mammal Authorization Program (MMAP) documented a self-reported incidental take (mortality) of a common bottlenose dolphin by a commercial fisherman trawling in Mobile Bay. The dolphin was entangled in the lazy line of the gear.

Menhaden Purse Seine

During 2015–2019 there was one mortality documented within waters of the Mississippi River Delta Stock that involved the menhaden purse seine fishery (Table 2). Through the Marine Mammal Authorization Program (MMAP), one animal was reported as entangled within a purse seine during 2018. There is currently no observer program for the Gulf of Mexico menhaden purse seine fishery.

Without an ongoing observer program, it is not possible to obtain statistically reliable incidental mortality and serious injury rates for this fishery, and the stocks from which common bottlenose dolphins are being taken. The documented mortality in this commercial fishery represents a minimum known count of mortalities and serious injuries in the last five years.

Blue Crab, Stone Crab and Florida Spiny Lobster Trap/Pot

During 2015–2019 there were nine documented interactions between trap/pot fisheries and BSE stocks. During 2019 two serious injuries occurred, one due to entanglement in commercial spiny lobster trap/pot gear, ascribed to the Florida Keys Stock, and the second due to entanglement in unidentified trap/pot gear, ascribed to the Waccasassa Bay Stock. Also during 2019, an animal was disentangled from commercial blue crab trap/pot gear and released alive. It could not be determined if the animal was seriously injured following mitigation efforts (the initial determination was seriously injured). This animal was ascribed to the Caloosahatchee River Stock. During 2017 one mortality and one serious injury occurred, both due to entanglement in commercial blue crab trap/pot gear. The mortality was ascribed to the Caloosahatchee River Stock, and the serious injury to the Waccasassa Bay Stock. During 2016 one animal was partially disentangled from unidentified trap/pot gear and released alive seriously injured. This animal was ascribed to the Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay Stock. Also in 2016, an animal was disentangled from commercial stone crab trap/pot gear and released alive not seriously injured following disentanglement efforts (the initial determination was seriously injured). This animal was ascribed to the Sarasota Bay/Little Sarasota Bay Stock. During 2015 one mortality occurred due to entanglement in commercial blue crab trap/pot gear. This animal was ascribed to the Mobile Bay/Bonsecour Bay Stock. Also in 2015, one animal was disentangled and released alive from unidentified crab trap/pot gear but it could not be determined if the animal was seriously injured following mitigation efforts (the initial determination was seriously injured). This freeze-branded animal was known to belong to the Sarasota Bay/Little Sarasota Bay Stock. The specific fishery could not be identified for the trap/pot gear involved in several of the live releases. The mortality and the animals released alive were all included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and are included in the stranding totals in Table 4. The details for serious determinations for the live animals are provided in Maze-Foley and Garrison (2021).

Because there is no observer program for these fisheries, it is not possible to estimate the total number of interactions or mortalities associated with trap/pot gear. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Gillnet

During 2015–2019, there was one documented interaction with gillnet gear and a BSE stock. During 2019, a stranded carcass was recovered with gillnet gear wrapped around its rostrum, and it was ascribed to the St. Vincent

Sound, Apalachicola Bay, St. George Sound Stock. There has been limited observer coverage of this fishery in state waters. During 2012–2018, NMFS placed observers on commercial vessels (state permitted gillnet vessels) in the coastal waters of Alabama, Mississippi, and Louisiana (Mathers et al. 2016). No takes were observed in state waters during this time. However, stranding data indicate that gillnet interactions do occur, causing mortality and serious injury. During 2015–2019, three stranded common bottlenose dolphins were recovered with markings indicative of interaction with gillnet gear (Read and Murray 2000), but no gear was attached to the carcasses and it is unknown whether the interactions with the gear contributed to the death of these animals. Two of the strandings were ascribed to the Mobile Bay Stock and one to the Perdido Bay Stock. Because there is no observer program within BSE waters, it is not possible to estimate total mortalities and serious injuries incidental to gillnet fisheries.

In 1995, a Florida state constitutional amendment banned gillnets and large nets from bays, sounds, estuaries, and other inshore waters. Commercial and recreational gillnet fishing is also prohibited in Texas state waters.

For details on research-related entanglements in gillnet gear, see the Other Mortality section and Table 3 below.

Hook and Line (Rod and Reel)

During 2015–2019 there were 20 documented interactions (entanglements or ingestions) between hook and line gear and BSE stocks—14 mortalities and six live animals (disentanglement efforts were made for four of the six). The stranding data indicate that, for six of the 14 mortalities, the hook and line gear interaction contributed to the cause of death. For five mortalities, evidence suggested the hook and line gear interaction was incidental and was not a contributing factor to cause of death. For three mortalities, it could not be determined if the hook and line gear interaction contributed to cause of death. Two live animals were considered seriously injured and no disentanglement efforts were made. Attempts were made to disentangle the remaining four live animals from hook and line gear. All four were considered seriously injured by the gear prior to mitigation efforts, but based on observations during mitigations, three animals were considered not seriously injured post-mitigation. For the remaining live animal, following mitigation it could not be determined if the animal was seriously injured. In summary, the evidence available from stranding data suggested that at least six mortalities and two serious injuries to animals from BSE stocks resulted from interactions with rod and reel hook and line gear. This number would have been higher without mitigation efforts to disentangle four live animals.

Interactions by year with hook and line gear were as follows: During 2015 there was one mortality. During 2016 there were three mortalities, two live animals considered seriously injured, and one live animal for which it could not be determined if it was seriously injured following disentanglement efforts (the initial determination was seriously injured). During 2017, there were four mortalities. During 2018 there were three mortalities and two live animals considered not seriously injured following disentanglement efforts (the initial determinations were seriously injured; one animal was initially sighted in 2018 and later disentangled in 2019). During 2019 there were three mortalities and one live animal considered not seriously injured following disentanglement efforts (the initial determination was seriously injured.

The mortalities and serious injuries likely involved animals from the following BSE stocks: Laguna Madre, Mobile Bay/Bonsecour Bay, Perdido Bay, Waccasassa Bay/Withlacoochee Bay/Crystal Bay, St. Joseph Sound/Clearwater Harbor, Tampa Bay, Sarasota Bay/Little Sarasota Bay, Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay, and Estero Bay.

All mortalities and live entanglements were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and are included in the stranding totals presented in Table 4. The details for serious determinations for the live animals are provided in Maze-Foley and Garrison (2021).

It should be noted that, in general, it cannot be determined if rod and reel hook and line gear originated from a commercial (i.e., charter boat or headboat) or recreational angler because the gear type used by both sources is typically the same. Also, it is not possible to estimate the total number of interactions with hook and line gear because there is no systematic observer program. The documented interactions in this gear represent a minimum known count of interactions in the last five years.

Other Mortality

A population model was developed to estimate long-term injury to stocks affected by the DWH oil spill (see Habitat Issues section), taking into account long-term effects resulting from mortality, reproductive failure, and reduced survival rates (DWH MMIQT 2015; Schwacke *et al*. 2017). For the Mississippi River Delta Stock, the model predicted the stock experienced a 71% (95% CI: 40–97) maximum reduction in population size due to the oil spill (DWH MMIQT 2015; Schwacke et al. 2017), and for the years 2015–2019, the model projected 45 mortalities. For the Mobile Bay/Bonsecour Bay Stock, the model predicted a 31% (95% CI: 20–51) maximum reduction in population size due to the oil spill (DWH MMIQT 2015; Schwacke *et al*. 2017), and for the years 2015–2019, the model projected 73 mortalities. This population model has a number of sources of uncertainty. Because no current abundance estimates existed at the time of the spill, the baseline population sizes were estimated from studies initiated after initial exposure to DWH oil occurred. Therefore, it is possible that the pre-spill population sizes were larger than this baseline level and some mortality occurring early in the event was not quantified. The duration of elevated mortality and reduced reproductive success after exposure is unknown, and expert opinion was used to predict the rate at which these parameters would return to baseline levels. Where possible, uncertainty in model parameters was included in the estimates of excess mortality by re-sampling from statistical distributions of the parameters (DWH MMIQT 2015; DWH NRDAT 2016; Schwacke *et al*. 2017).

There were two live dolphins during 2015–2019 that were entangled in unidentified fishing gear or unidentified gear, and one occurred in the Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay Stock area in 2017 and the other occurred in Perdido Bay in 2018. The animal from 2018 was considered not seriously injured, and the 2017 animal was initially considered seriously injured, but following mitigation efforts, was released alive without serious injury (Maze-Foley and Garrison 2018). During 2015 an animal in the St. Joseph Sound/Clearwater Harbor Stock area (Florida) was released alive without serious injury following entrapment behind an oil boom (Maze-Foley and Garrison 2018). During 2016 there was a dead dolphin in the Copano Bay/Aransas Bay/San Antonio Bay/Redfish Bay/Espiritu Santo Bay Stock area found entangled in electrical cord. It is unknown whether the entanglement contributed to the death of the animal. All of these cases were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and are included in the stranding totals presented in Table 4.

In addition to animals included in the stranding database, during 2015–2019, there were 42 at-sea observations in BSE stock areas of common bottlenose dolphins entangled in fishing gear or unidentified gear (hook and line, crab trap/pot and unidentified gear/line/rope) or displaying vessel-strike injuries. In 27 of these cases, the animals were seriously injured; in 6 cases the animals were not seriously injured, and for the remaining 9 cases, it could not be determined (CBD) if the animals were seriously injured (Maze-Foley and Garrison 2021; see Table 2).

Table 2. At-sea observations of common bottlenose dolphins entangled in fishing gear or unidentified gear during 2015–2019, including the serious injury determination (mortality, serious injury, not a serious injury [Not serious], or could not be determined [CBD] if seriously injured) and stock to which each animal likely belonged based on sighting location. Further details can be found in Maze-Foley and Garrison (2021).

Year (Identifier from Maze-Foley and Garrison [2021])	Determination	Stock
2015 (row 92)	Serious injury	Calcasieu Lake
2015 (row 93)	Not serious	Tampa Bay
2015 (row 98)	Serious injury	Tampa Bay
2015 (row 99)	Serious injury	Laguna Madre
2015 (row 101)	CBD	Sarasota Bay/Little Sarasota Bay
2015 (row 102)	Serious injury	St. Joseph Sound/Clearwater Harbor

2015 (row 104)	CBD	Mobile Bay/Bonsecour Bay (or Northern Coastal)
2015 (row 106)	Not serious	Sarasota Bay/Little Sarasota Bay
2015 (row 109)	CBD	Apalachee Bay
2016 (row 120)	Serious injury	Laguna Madre
2016 (row 126)	CBD	St. Joseph Sound/Clearwater Harbor
2016 (row 127)	Serious injury	Mobile Bay/Bonsecour Bay
2017 (row 129)	CBD	Sarasota Bay/Little Sarasota Bay
2017 (row 130)	CBD	Sarasota Bay/Little Sarasota Bay
2017 (row 131)	Serious injury	undefined stock area (Miller's Bayou, Florida; in between the Waccasassa Bay/Withlacoochee Bay/Crystal Bay Stock and the St. Joseph Sound/Clearwater Harbor Stock)
2017 (row 135)	Serious injury	Sarasota Bay/Little Sarasota Bay
2017 (row 137)	Serious injury	Copano Bay/Aransas Bay/San Antonio Bay/Redfish Bay/Espiritu Santo Bay
2017 (row 139)	Serious injury	Tampa Bay
2017 (row 140)	Serious injury	Tampa Bay
2017 (row 148)	Serious injury	Tampa Bay
2017 (row 150)	Serious injury	St. Joseph Sound/Clearwater Harbor
2018 (row 153)	Serious injury	Tampa Bay (or Eastern Coastal)
2018 (row 155)	CBD	Tampa Bay
2018 (row 156)	CBD	St. Joseph Sound/Clearwater Harbor (or Eastern Coastal)
2018 (row 158)	Not serious	Chokoloskee Bay/Ten Thousand Islands/Gullivan Bay

2018 (row 160)	Serious injury	Estero Bay
2018 (row 162)	Serious injury	Laguna Madre
2018 (row 166)	Serious injury	Perdido Bay
2018 (row 168)	CBD	Perdido Bay
2018 (row 171)	Serious injury	Tampa Bay
2018 (row 25, vessel strike tab)	Serious injury	Perdido Bay
2019 (row 172)	Not serious	Chokoloskee Bay/Ten Thousand Islands/Gullivan Bay
2019 (row 173)	Serious injury	Chokoloskee Bay/Ten Thousand Islands/Gullivan Bay
2019 (row 175)	Serious injury	Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay
2019 (row 176)	Serious injury	Tampa Bay
2019 (row 179)	Not serious	St. Joseph Sound/Clearwater Harbor (or Eastern Coastal)
2019 (row 182/183)	Serious injury	Tampa Bay
2019 (row 189)	Serious injury	Tampa Bay
2019 (row 190)	Serious injury	Tampa Bay
2019 (row 192)	Not serious	Tampa Bay or St. Joseph Sound/Clearwater Harbor
2019 (row 194)	Serious injury	Laguna Madre
2019 (row 27, vessel strike tab)	Serious injury	Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay

Interactions between common bottlenose dolphins and research-fishery gear are also known to occur. During 2015–2019, nine dolphins were entangled in research-related gillnets—in Texas (7), Alabama (1) and Florida (1). One of the nine entanglements resulted in a mortality; five entanglements resulted in serious injuries; and three entanglements were released alive without serious injury (Maze-Foley and Garrison 2021; see Table 3). All of the interactions with research gear were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020).

Table 3. Research-related takes of common bottlenose dolphins during 2015–2019, including the serious injury determination for each animal (mortality, serious injury, not a serious injury [Not serious], or could not be determined ([CBD)] if seriously injured) and stock to which each animal likely belonged based on location of the interaction. All of these interactions were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). Further details on injury determinations can be found in Maze-Foley and Garrison (2021).

Year	Gear Type	Determination	Stock
2015	Gillnet	Serious injury	Matagorda Bay/Tres Palacios Bay/Lavaca Bay
2016	Gillnet	Serious injury	Matagorda Bay/Tres Palacios Bay/Lavaca Bay
2016	Gillnet	Not serious	Laguna Madre
2017	Gillnet	Serious injury	Copano Bay/Aransas Bay/San Antonio Bay/Redfish Bay/Espiritu Santo Bay
2018	Gillnet	Not serious	Sarasota Bay/Little Sarasota Bay
2019	Gillnet	Not serious	Perdido Bay
2019	Gillnet	Mortality	Nueces Bay/Corpus Christi Bay
2019	Gillnet	Serious injury	Laguna Madre
2019	Gillnet	Serious injury	Copano Bay/Aransas Bay/San Antonio Bay/Redfish Bay/Espiritu Santo Bay

NOAA's Office of Law Enforcement has been investigating increasing numbers of reports from the northern Gulf of Mexico coast of violence against common bottlenose dolphins, including shootings using guns and bows and arrows, throwing pipe bombs and cherry bombs, and stabbings (Vail 2016). There have been several documented stabbings of BSE common bottlenose dolphins in recent years. In 2018, an animal was impaled by a metal rod resulting in mortality, and this mortality was ascribed to the Pensacola Bay/East Bay Stock. Also in 2018, an animal ascribed to the Tampa Bay Stock was documented with a puncture wound associated with fractured vertebrae and a necrotic tissue track, likely resulting in mortality. In 2019, an animal was stabbed/impaled in its head with a spear-like object while the animal was still alive, resulting in mortality. This animal was ascribed to the Pine Island Sound/Charlotte Harbor/Gasparilla Sound/Lemon Bay Stock. All three of these cases were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020) and in Table 4.

Depredation of fishing catch and/or bait is a growing problem in the Gulf of Mexico and globally, and can lead to serious injury or mortality via ingestion of or entanglement in gear (e.g., Zollett and Read 2006; Read 2008; Powell and Wells 2011; Vail 2016), as well as changes to the dolphin's activity patterns, such as decreases in natural foraging (Powell and Wells 2011). It has been suggested that provisioning of wild common bottlenose dolphins may encourage depredation because provisioning conditions dolphins to approach humans and vessels, where they then may prey on bait and catches (Vail 2016). Christiansen et al. (2016) found that via direct and indirect food provisioning, an increasing percentage of the long-term Sarasota Bay residents were becoming conditioned to human interactions. In addition, when comparing conditioned to unconditioned dolphins, Christiansen et al. (2016) reported it was more likely for a conditioned dolphin to be injured by human interactions.

Illegal feeding or provisioning of wild common bottlenose dolphins has been documented in Florida, particularly near St. Andrew Bay (Panama City Beach) in the Panhandle (Samuels and Bejder 2004; Powell *et al.* 2018) and in and near Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, a high rate of provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004) and in 2014 (Powell et al. 2018), and provisioning was observed frequently and predictably south of Sarasota Bay during 1990–2007 (Cunningham-Smith *et al*. 2006; Powell and Wells 2011). Provisioning of four dolphins was documented within the Tampa Bay Stock area during 2019 while the dolphins were swimming in a local canal (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, at least 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011).

Swimming with wild common bottlenose dolphins has also been documented in Florida in Key West (Samuels and Engleby 2007) and near Panama City Beach (Samuels and Bejder 2004). Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to illegal provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

As noted previously, common bottlenose dolphins are known to be struck by vessels (Wells and Scott 1997; Wells *et al.* 2008). During 2015–2019, 16 stranded bottlenose dolphins (of 523 total strandings) showed signs of a boat collision (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). It is possible some of the instances were post-mortem collisions. In addition to vessel collisions, the presence of vessels may also impact common bottlenose dolphin behavior in bays, sounds and estuaries. Nowacek *et al.* (2001) reported that boats pass within 100 m of each bottlenose dolphin in Sarasota Bay once every six minutes on average, leading to changes in dive patterns and group cohesion. Buckstaff (2004) noted changes in communication patterns of Sarasota Bay dolphins when boats approached. Miller *et al*. (2008) investigated the immediate responses of common bottlenose dolphins to "high-speed personal watercraft" (i.e., recreational boats) in Mississippi Sound. They found an immediate impact on dolphin behavior demonstrated by an increase in traveling behavior and dive duration, and a decrease in feeding behavior for non-traveling groups. The findings suggested that dolphins attempted to avoid high-speed personal watercraft. It is likely that repeated short-term effects will result in long-term consequences like reduced health and viability or habitat displacement of dolphins (Bejder *et al*. 2006). Further studies are needed to determine the impacts throughout the Gulf of Mexico.

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. Historically, there have been interactions, including mortalities, documented for common bottlenose dolphins likely belonging to BSE stocks. However, no interactions with common bottlenose dolphins have been documented during the most recent five years, 2015–2019.

Historically, there have been two documented mortalities of common bottlenose dolphins during health-assessment research projects in the Gulf of Mexico, but none have occurred during the most recent five years, 2015–2019.

Some of the BSE communities were the focus of a live-capture fishery for common bottlenose dolphins which supplied dolphins to the U.S. Navy and to oceanaria and laboratories for research and public display for more than two decades (Reeves and Leatherwood 1984; Scott 1990). Between 1973 and 1988, 533 common bottlenose dolphins were removed from Southeastern U.S. waters (Scott 1990). The impact of these removals on the stocks is unknown. In 1989, the Alliance of Marine Mammal Parks and Aquariums declared a self-imposed moratorium on the capture of common bottlenose dolphins in the Gulf of Mexico (Corkeron 2009).

Strandings

During 2015–2019, 527 common bottlenose dolphins were found stranded within bays, sounds and estuaries of the northern Gulf of Mexico (Table 4; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 25 August 2020). There was evidence of human interaction for 102 of the strandings. No evidence of human interaction was detected for 25 strandings, and for the remaining 400 strandings, it could not be determined if there was evidence of human interaction. Human interactions were from numerous sources, including entanglements with hook and line gear, trap/pot gear, commercial shrimp trawl gear, research gillnet gear, stabbings/impalements, an entrapment between oil booms, and animals with evidence of a vessel strike (see Table 4). Strandings with evidence of fishery-related interactions are reported above in the respective gear sections. It should be noted that evidence of human interaction does not necessarily mean the interaction caused the animal's stranding or death.

There are a number of difficulties associated with the interpretation of stranding data. Except in rare cases, such as Sarasota Bay, Florida, where residency can be determined, it is possible that some or all of the stranded dolphins may have been from a nearby coastal stock. However, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcasses originated. Stranding data underestimate the extent of human and fishery-related mortality and serious injury because not all of the dolphins that die or are seriously injured in human interactions wash ashore, or, if they do, they are not all recovered (Peltier et al. 2012; Wells et al. 2015; Carretta et al. 2016). Additionally, not all carcasses will show evidence of human interaction, entanglement, or other fishery-related interaction due to decomposition, scavenger damage, etc. (Byrd et al. 2014). Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction.

Since 1990, there have been 15 common bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico (Litz et al. 2014; http://www.nmfs.noaa.gov/pr/health/mmume/events.html, accessed 5 November 2020).

1) From January through May 1990, 344 common bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded number of strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992), however, morbillivirus may have contributed to this event (Litz et al. 2014).

2) A UME was declared for Sarasota Bay, Florida, in 1991 involving 31 common bottlenose dolphins. The cause was not determined, but it is believed biotoxins may have contributed to this event (Litz et al. 2014).

3) In March and April 1992, 119 common bottlenose dolphins stranded in Texas - about nine times the average number. The cause of this event was not determined, but low salinity due to record rainfall combined with pesticide runoff and exposure to morbillivirus were suggested as potential contributing factors (Duignan et al. 1996; Colbert et al. 1999; Litz et al. 2014).

4) In 1993–1994 a UME of common bottlenose dolphins caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb et al. 1994; Litz et al. 2014). From February through April 1994, 236 common bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period.

5) In 1996 a UME was declared for common bottlenose dolphins in Mississippi when 31 common bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) harmful algal bloom was suspected to be responsible (Litz et al. 2014).

6) Between August 1999 and May 2000, 150 common bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included three Atlantic spotted dolphins, *Stenella frontalis*, one Risso's dolphin, *Grampus griseus*, two Blainville's beaked whales, *Mesoplodon densirostris*, and four unidentified dolphins. Brevetoxin was determined to be the cause of this event (Twiner et al. 2012; Litz et al. 2014).

7) In March and April 2004, in another Florida Panhandle UME attributed to *K. brevis* blooms, 105 common bottlenose dolphins and two unidentified dolphins stranded dead (Litz et al. 2014). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling et al. 2005; Twiner et al. 2012).

8) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. In total, 190 dolphins were involved, primarily common bottlenose dolphins (plus strandings of one Atlantic spotted dolphin and 23 unidentified dolphins). The evidence suggests a red tide bloom contributed to the cause of this event (Litz et al. 2014).

9) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of most of the stranded dolphins and determined to be the cause of the event (Twiner et al. 2012; Litz et al. 2014). Between September 2005 and April 2006 when the event was officially declared over, a total of 88 common bottlenose dolphin strandings occurred (plus strandings of five unidentified dolphins).

10) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 64 common bottlenose dolphins and two unidentified dolphins. Decomposition prevented conclusive analyses on most carcasses (Litz et al. 2014).
11) During February and March of 2008 an additional event was declared in Texas involving 111 common bottlenose dolphin strandings (plus strandings of one unidentified dolphin and one melon-headed whale, *Peponocephala electra*). Most of the animals recovered were in a decomposed state. A direct cause could not be identified. However, there were numerous, co-occurring harmful algal bloom toxins detected during the time period of this UME which may have contributed to the mortalities (Fire et al. 2011).
12) A UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010 and ending 31 July 2014 (Litz et al. 2014; http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 1 June 2016). The UME began a few months prior to the DWH oil spill, however most of the strandings prior to May 2010 were in Lake Pontchartrain, Louisiana, and western Mississippi and were likely a result of low salinity and cold temperatures (Venn-Watson et al. 2015a). The largest increase in strandings (compared to historical data) occurred after May 2010 following the DWH spill, and strandings were focused in areas exposed to DWH oil. Investigations to date have determined that the DWH oil spill is the primary underlying cause of the elevated stranding numbers in the northern Gulf of Mexico after the spill (e.g., Schwacke et al. 2014; Venn-Watson et al. 2015b; Colegrove et al. 2016; DWH NRDAT 2016; see Habitat Issues section).
13) A UME occurred from November 2011 to March 2012 across five Texas counties and included 126 common bottlenose dolphin strandings. The strandings were coincident with a harmful algal bloom of *K. brevis*, but researchers have not determined that was the cause of the event. During 2011, six animals from BSE stocks were considered to be part of the UME; during 2012, 24 animals.
14) A bottlenose dolphin UME occurred in southwest Florida from 1 July 2018 through 30 June 2019, with peak strandings occurring between 1 July 2018 and 30 April 2019. A total of 183 dolphins were reported (note the dates and numbers are subject to change as the closure package has not yet been approved by the UME Working Group). All age classes of dolphins were represented and the majority of the animals recovered were in moderate to advanced stages of decomposition. The cause of the bottlenose dolphin UME was determined to be due to biotoxin exposure from the K. brevis harmful algal bloom off the coast of southwest Florida. The additional supporting evidence of fish kills and other species die-offs linked to brevetoxin during the same time and space support that the impacts of the harmful algal bloom caused the dolphin mortalities (Rycyk *et al.* 2020).
15) During 1 February 2019 to 30 November 2019, a UME was declared for the area from the eastern border of Taylor County, Florida, west through Alabama, Mississippi, and Louisiana (http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 5 November 2020). A total of 337 common bottlenose dolphins stranded during this event. The largest number of mortalities occurred in eastern Louisiana and Mississippi. An investigation concluded the event was caused by exposure to low salinity waters as a result of extreme freshwater discharge from rivers. The unprecedented amount of freshwater discharge during 2019 (e.g., Gasparini and Yuill 2020) resulted in low salinity levels across the region.

Table 4. Common bottlenose dolphin strandings occurring in bays, sounds, and estuaries in the northern Gulf of Mexico from 2015 to 2019, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 25 August 2020). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that this table does not include strandings from West Bay, Galveston Bay/East Bay/Trinity Bay, Terrebonne-Timbalier Bay Estuarine System, Barataria Bay Estuarine System, Mississippi Sound/Lake Borgne/Bay Boudreau, Choctawhatchee Bay, St. Andrew Bay, and St. Joseph Bay.

Category	2015	2016	2017	2018	2019	Total
Total Stranded	68	87	91	115	166	527
HI--Yes	12a	23b	18c	16d	33e	102
HI--No	1	3	7	8	6	25

HI--CBD	55	61	66	91	127	400

a. Includes 1 entanglement interaction with hook and line gear (mortality); 1 entanglement interaction in commercial blue crab trap/pot gear (mortality); 1 entanglement interaction with unidentified trap/pot gear (released alive, could not be determined if seriously injured or not); 1 entanglement interaction with research gillnet gear (released alive, seriously injured); 1 live release without serious injury following entrapment between oil booms (animal was initially seriously injured, but due to mitigation efforts, was released without serious injury); and 3 animals with evidence of a vessel strike (2 mortalities, 1 live animal without serious injury).

b. Includes 6 entanglement interactions with hook and line gear (3 mortalities [1 also had evidence of a vessel strike and 1 had evidence of entanglement with shrimp trawl gear] and 3 released alive seriously injured); 6 mortalities with evidence of a vessel strike (1 was also an entanglement interaction with hook and line gear); 1 entanglement interaction with trap/pot gear (released alive, seriously injured); 1 entanglement interaction with commercial stone crab trap/pot gear (live animal without serious injury); 1 entanglement interaction with research gillnet gear (released alive, seriously injured); and 1 entanglement interaction with shrimp trawl gear (mortality, also an interaction with hook and line gear); and 1 animal with markings indicative of interaction with gillnet gear (mortality).

c. Includes 3 entanglement interactions with hook and line gear (mortalities), 1 entanglement interaction with commercial blue crab trap/pot gear (mortality); 1 entanglement interaction with trap/pot gear (released alive, seriously injured); 1 entanglement interaction with research gillnet gear (released alive, seriously injured); and 4 animals with evidence of a vessel strike (mortalities).

d. Includes 5 entanglement interactions with hook and line gear (3 mortalities and 2 animals initially seriously injured, but due to mitigation efforts, were released alive without serious injury); 2 stabbings (mortalities); 1 animal with markings indicative of interaction with gillnet gear (mortality); and 1 entanglement in possible gillnet gear (live animal without serious injury)

e. Includes 4 entanglement interactions with hook and line gear (3 mortalities and 1 animal initially seriously injured, but due to mitigation efforts, was released alive without serious injury); 1 stabbing (mortality); 3 animals with evidence of a vessel strike (mortalities); 1 entanglement interaction with commercial blue crab trap/pot gear (animal was initially seriously injured, but due to mitigation efforts, was released without serious injury); 1 entanglement interaction with crab trap/pot gear (mortality); 1 entanglement interaction with commercial spiny lobster trap/pot gear (seriously injured); 1 animal with markings indicative of interaction with gillnet gear (mortality); 4 entanglement interactions with research gillnet gear (1 mortality and 3 live animals, 2 of which were seriously injured and 1 without serious injury); and 1 interaction with unidentified gillnet gear (mortality).

HABITAT ISSUES

Issues Related to the Deepwater Horizon (DWH) Oil Spill

The DWH MC252 drilling platform, located approximately 80 km southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and over 87 days up to ~3.2 million barrels of oil were discharged from the wellhead until it was capped on 15 July 2010 (DWH NRDAT 2016). A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011; Michel *et al*. 2013). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi's mainland coast, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana. Heavy to light oiling occurred on Mississippi's barrier islands (Michel *et al*. 2013).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies were conducted to determine potential impacts of the spill on marine mammals. These studies estimated that for the Mississippi River Delta Stock of common bottlenose dolphins, 46% (95% CI: 21–65) of females suffered from reproductive failure, and 37% (95% CI: 14–57) suffered adverse health effects (DWH MMIQT 2015). A population model estimated that the stock experienced a 71% maximum reduction in population size (see Other Mortality section above). For the Mobile Bay Stock of common bottlenose dolphins, 46% (95% CI: 21–65) of females suffered from reproductive failure, and 24% (95% CI: 0–48) suffered adverse health effects (DWH MMIQT 2015). The population model estimated that the stock experienced a 31% maximum reduction in population size (see Other Mortality).

Stranding rates in the northern Gulf of Mexico rose significantly in the years of and following the DWH oil spill to levels higher than previously recorded (Litz *et al*. 2014; Venn-Watson *et al*. 2015b) and a UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 March 2010 and ending 31 July 2014 (Litz *et al*. 2014; http://www.nmfs.noaa.gov/pr/health/mmume/cetacean_gulfofmexico.htm, accessed 1 June 2016). The primary cause for the UME was attributed to exposure to the DWH oil spill (Venn-Watson *et al.* 2015a; Colegrove *et al*. 2016; DWH NRDAT 2016) as other possible causes (e.g., morbillivirus infection, brucellosis, and biotoxins) were ruled out (Venn-Watson *et al*. 2015a). Balmer *et al*. (2015) indicated it is unlikely that persistent organic pollutants (POPs) significantly contributed to the unusually high stranding rates following the DWH oil spill. POP concentrations in dolphins sampled between 2010 and 2012 at six northern Gulf sites that experienced DWH oiling were comparable to or lower than those previously measured by Kucklick *et al*. (2011) from southeastern U.S. sites; however, the authors cautioned that potential synergistic effects of oil exposure and POPs should be considered as the extra stress from oil exposure added to the background POP levels could have intensified toxicological effects.

The DWH NRDA Trustees quantified injuries to four BSE stocks of common bottlenose dolphins, including two stocks included in this report, the Mississippi River Delta Stock and the Mobile Bay/Bonsecour Bay Stock, as well two stocks that have their own SARs (Barataria Bay Estuarine System Stock and Mississippi Sound/Lake Borgne/Bay Boudreau Stock). A suite of research efforts indicated the DWH oil spill negatively affected these stocks of common bottlenose dolphins (Schwacke *et al*. 2014; Venn-Watson *et al*. 2015a; Colegrove *et al*. 2016). Capture-release health assessments and analysis of stranded dolphins during the oil spill both found evidence of moderate to severe lung disease and compromised adrenal function (Schwacke *et al*. 2014; Venn-Watson *et al*. 2015a). Colegrove *et al*. (2016) examined perinate strandings in Louisiana, Mississippi, and Alabama during 2010–2013 and found that common bottlenose dolphins were prone to late-term failed pregnancies and in utero infections, including pneumonia and brucellosis.

In the absence of any additional non-natural mortality or restoration efforts, the DWH damage assessment estimated the Mississippi River Delta Stock will take 52 years to recover to pre-spill population size, and the Mobile Bay/Bonsecour Bay Stock, 31 years (DWH MMIQT 2015).

Other Habitat Issues

The nearshore habitat occupied by many of these stocks is adjacent to areas of high human population, and in some bays, such as Mobile Bay in Alabama and Galveston Bay in Texas, is highly industrialized. Many of the enclosed bays in Texas are surrounded by agricultural lands that receive periodic pesticide applications.

Concentrations of chlorinated hydrocarbons and metals were examined in conjunction with an anomalous mortality event of common bottlenose dolphins in Texas bays in 1990 and found to be relatively low in most; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al*. 1992). No studies to date have determined the amount, if any, of indirect human-induced mortality resulting from pollution or habitat degradation.

Analyses of organochlorine concentrations in the tissues of common bottlenose dolphins in Sarasota Bay, Florida, have found that the concentrations in male dolphins exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al*. 2002). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring, and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuary dolphins, the exposure to environmental pollutants and subsequent effects on population health are areas of concern and active research.

STATUS OF STOCKS

The status of these stocks relative to optimum sustainable population is unknown and this species is not listed as threatened or endangered under the Endangered Species Act. The occurrence of 15 Unusual Mortality Events (UMEs) among common bottlenose dolphins along the northern Gulf of Mexico coast since 1990 (Litz *et al*. 2014; http://www.nmfs.noaa.gov/pr/health/mmume/events.html, accessed 5 November 2020) is cause for concern. Notably, stock areas in Louisiana, Mississippi, Alabama, and the western Florida panhandle have recently been impacted by several UMEs. However, the effects of the mortality events on stock abundance have not yet been determined, in large part because it has not been possible to assign mortalities to specific stocks and a lack of current abundance estimates for some stocks.

Human-caused mortality and serious injury for each of these stocks is unknown. Considering the evidence from stranding data (Table 4) and the low PBRs for stocks with recent abundance estimates, the total fishery-related mortality and serious injury likely exceeds 10% of the total known PBR or previous PBR, and therefore, it is probably not insignificant and not approaching the zero mortality and serious injury rate. NMFS considers each of these stocks, except for the Sabine Lake, Mississippi River Delta, and Sarasota Bay/Little Sarasota Bay stocks, to be strategic because most of the stock sizes are currently unknown, but are likely small such that relatively few mortalities and serious injuries would exceed PBR.

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Appendix I: Estimated mortality and serious injury (M/SI) of Western North Atlantic marine mammals listed by U.S. observed fisheries. Marine mammal species with zero (0) observed M/SI are not shown in this table. (unk = unknown). Note: None of these stocks were updated for this 2022 report, so 2019 is the most recent year reported.

Category, Fishery, Species	Years Observed	Observer Coverage	Est. SI by Year (CV)	Est. Mortality by Year (CV)	Mean Annual Mortality (CV)	PBR
CATEGORY I						
Gillnet Fisheries: Northeast Gillnet						
Harbor Porpoise	2015-2019	.14, .10, .12, .11, .12	0, 0, 7, 0, 0	177 (.28), 125 (.34), 129 (.28), 92 (.52), 195(.23)	145 (.14)	851
Common Dolphin	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	55 (.54), 80 (.38), 133 (.28), 93 (.45), 5 (.68)	73 (.19)	1,452
Risso’s Dolphin	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	0, 0, 0, 0, 5 (.7)	1 (3.5)	303
Bottlenose Dolphin, Offshore	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	0, 0, 8 (.92), 0, 0	2.0 (.46)	561
Harbor Seal	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	474 (.17), 245 (.29), 298 (.18), 188 (.36), 316 (.15)	304 (.10)	2,006
Gray Seal	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	1021 (.25), 498 (.33), 930 (.16), 1113 (.32), 2019 (.17)	1116 (.11)	1,389
Harp Seal	2015-2019	.14, .10, .12, .11, .12	0, 0, 0, 0, 0	119 (.34), 85 (.50), 44 (.37), 14 (.8), 163 (.19)	85 (.16)	unk
Gillnet Fisheries: US Mid-Atlantic Gillnet						
Harbor Porpoise	2015-2019	.06, .08, .09, .09, .13	0, 0, 0, 0, 0	33 (1.16), 23 (.64), 9 (.95), 0, 13 (.51)	16 (.68)	851
Common Dolphin	2015-2019	.06, .08, .09, .09, .13	0, 0, 11, 0, 0	30 (.55), 7 (.97), 11 (.71), 8 (.91), 20 (.56)	17 (.31)	1,452
Harp Seal	2015-2019	.06, .08, .09, .09, .13	0, 0, 0, 0, 0	0, 0, 0, 0, 29 (.84)	6 (4.2)	unk
Harbor Seal	2015-2019	.06, .08, .09, .09, .13	0, 0, 0, 0, 0	48 (.52), 18 (.95), 3 (.18), 26 (.52), 17 (.35)	22 (.30)	2,006
Gray Seal	2015-2019	.06, .08, .09, .09, .13	0, 0, 0, 0, 0	15 (1.04), 7 (.93), 0, 0, 18 (.40)	8.0 (76)	1,389
Minke Whale	2015-2019	.06, .08, .09, .09, .13	0, 0, 0, 0, 0	0, 1, 0, 0, 0	0.2	14
Longline Fisheries: Pelagic Longline (Excluding NED-E)						

Category, Fishery, Species	Years Observed	Observer Coverage	Est. SI by Year (CV)	Est. Mortality by Year (CV)	Mean Annual Mortality (CV)	PBR
Risso's Dolphin	2015-2019	.12, .15, .12, .10, .10	8.4 (.71), 10.5 (.69), 0.2 (1), 0.2 (.94), 0	0, 5.6 (1), 0, 0, 0	5.0 (.44)	303
Short-finned Pilot Whale	2015-2019	.12, .15, .12, .10, .10	200 (.24), 106 (.31), 133 (.29), 102 (.39), 131 (.37)	0, 5.1 (1.9), 0, 0, 0	136 (.14)	236
Long-finned Pilot Whale	2015-2019	.12, .15, .12, .10, .10	2.2 (.49), 1.1 (1), 3.3 (.98), 0.4 (.93), 0.4 (1)	0, 0, 0, 0, 0	1.5 (.49)	306
Common Dolphin	2015-2019	.12, .15, .12, .10. .10	9.1 (1), 0, 4.9 (1), 1.4 (1), 0	0, 0, 0, 0, 0	3.1 (.67)	1,452
CATEGORY II						
Trawl Fisheries: Northeast Bottom Trawl						
Harp Seal	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	0, 0, 0, 0, 5.4 (.89)	1.1 (.89)	unk
Harbor Seal	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	0, 0, 8.3 (.96), 0, 5.4 (.88)	2.7 (.68)	2,006
Gray Seal	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	23 (.46), 0, 16 (.24), 32 (.42), 30 (.37)	20 (.23)	1,389
Risso’s Dolphin	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	0, 17 (.88), 0, 0, 0	3.4 (.88)	303
Bottlenose Dolphin, Offshore	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	19 (.65), 34 (.89), 0, 0, 5.6 (.92)	11.5 (.56)	519
Long-finned Pilot Whale	2015-2019	.19, .12, .16, .12, 16	0, 6, 0, 0, 0	0, 29 (.58), 0, 0, 5.4 (.88)	6.9 (.51)	306
Common Dolphin	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	22(.45), 16(.46), 0, 28(.54), 10 (.62)	15 (.27)	1,452
Atlantic White-sided Dolphin	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 7.4	15 (.52), 28 (.46), 15(.64), 0, 79 (.28)	27 (.21)	544
Harbor Porpoise	2015-2019	.19, .12, .16, .12, 16	0, 0, 0, 0, 0	0, 0, 0, 0, 11 (.63)	2.2 (.63)	851
Mid-Atlantic Bottom Trawl						
Common Dolphin	2015-2019	.09, .10, .10, .12, .12	0, 0, 0, 5, 15	250 (.32), 177 (.33), 380 (.23), 200 (.54), 395 (.23)	281 (.12)	1,452
Risso’s Dolphin	2015-2019	.09, .10, .10, .12, .12	0, 0, 27, 0, 12	40(.63), 39 (.56), 43 (.51), 0, 0	24 (.33)	303
Bottlenose Dolphin, Offshore	2013-2017	.06, .08, .09, .10, .10	0, 0, 0, 0, 0	0, 7.3 (.93), 22 (.66), 6.3 (.91), 0	7.2 (.48)	561
Harbor Seal	2015-2019	.09, .10, .10, .12, .12	0, 0, 0, 0, 0	7, 0, 0, 6 (.94), 7.3 (.93)	4.1 (0.56)	2,006

Category, Fishery, Species	Years Observed	Observer Coverage	Est. SI by Year (CV)	Est. Mortality by Year (CV)	Mean Annual Mortality (CV)	PBR
Gray Seal	2015-2019	.09, .10, .10, .12, .12	0, 0, 0, 0, 0	0, 26 (.57), 26 (.40), 56 (.58), 22 (.53)	26 (.30)	1,389
Northeast Mid-water Trawl (Including Pair Trawl)						
Long-finned Pilot Whale	2015-2019	.08, .27, .16, .14, .28	0, 0, 0, 0, 0	0, .6 (na), 0, 0, 0	0.6 (na)	306
Harbor Seal	2015-2019	.08, .27, .16, .14, .28	0, 0, 0, 0, 0	.4 (na), .2 (na), 0, 0, 0	0.6 (na)	2,006
Gray Seal	2015-2019	.08, .27, .16, .14, .28	0, 0, 0, 0, 0	0, 0, 0, .2 (na), 0	0.2 (na)	1,389

Appendix II: Summary of the confirmed observed human-caused mortality and serious injury (M/SI) events involving baleen whale stocks along the Gulf of Mexico Coast, U.S. East Coast, and adjacent Canadian Maritimes, 2016–2020, with number of events attributed to entanglements or vessel collisions by year.

Stock	Mean Annual M/SI rate (PBR[1] for reference)	Entanglements Annual Rate (U.S. waters, Canadian waters, unknown first sighted in U.S., unknown first sighted in Canada)	Entanglements Confirmed Mortalities (2016, 2017, 2018, 2019, 2020)	Entanglements Injury Value Against PBR (2016, 2017, 2018, 2019, 2020)	Vessel Collisions Annual Rate (U.S. waters, Canadian waters, unknown first sighted in U.S., unknown first sighted in Canada)	Vessel Collisions Confirmed Mortalities (2016, 2017, 2018, 2019, 2020)	Vessel Collisions Injury Value Against PBR (2016, 2017, 2018, 2019, 2020)	Mean Annual Mortality due to other human-caused sources including plastic ingestion, oil spill, etc. (2016–2020)
Western North Atlantic Right Whale ***(Eubalaena glacialis)***	8.1 (0.8)	5.70 (0.00/ 2.15/ 2.65/ 0.9)	(2, 4, 3, 1, 1)	(7.5, 2, 4.25, 1, 2.75)	2.40 (0.80/ 1.60/ 0.00/ 0.00)	(1, 5, 0, 4, 1)	(0, 0, 0, 0, 1)	0
Gulf of Maine Humpback Whale ***(Megaptera novaeangliae)***[2]	16.65 (22)	9.95 (2.70/ 0.45/ 6.30/ 0.50)	(3, 2, 3, 1, 4)	(8, 6, 9.25, 6, 7.5)	6.70 (5.9/ 0.00/ 0.80/ 0.00)	(5, 8, 7, 5, 3)	(2, 1, 2, 0.52, 0)	0
Western North Atlantic Fin Whale ***(Balaenoptera physalus)***	1.95 (11)	1.55 (0.00/ 0.80/ 0.45/ 0.30)	(0, 1, 1, 2, 0)	(2.25, 0, 0, 0, 1.5)	0.40 (0.40/ 0.00/ 0.00/ 0.00)	(0, 1, 1, 0, 0)	0	0
Nova Scotian Sei Whale ***(B. borealis)***	0.8 (6.2)	0.4 (0, 0, 0.4, 0)	(0, 0, 1, 0, 0)	(0, 1, 0, 0, 0)	0.20 (0.20/ 0.00/ 0.00/ 0.00)	(1, 0, 0, 0, 0)	0	0.2
Canadian East Coast Minke Whale ***(B. acutorostrata)***	**9.45** (170)	8.85 (3.55/ 2.25/ 2.00/ 1.05)	(3, 12, 11, 3, 5)	(1.75, 1.5, 2.25, 3.75, 1)	0.60 (0.40/ 0.20/ 0.00/ 0.00)	(0, 2, 1, 0, 0)	0	0
Northern Gulf of Mexico Rice's whale (B. ricei)	0.5 (0.07)	0	0	0	0	0	0	0.5

[1] Potential Biological Removal (PBR)

[2] Humpback, fin, sei and minke SARs not updated in 2022– values reported here are published in Henry *et al* 2022.

Appendix III: Fishery Descriptions

This appendix is broken into two parts: Part A describes commercial fisheries that have documented interactions with marine mammals in the Atlantic Ocean; and Part B describes commercial fisheries that have documented interactions with marine mammals in the Gulf of Mexico. A complete list of all known fisheries for both oceanic regions, the List of Fisheries, is published in the *Federal Register* annually. Each part of this appendix contains three sections: (I) data sources used to document marine mammal mortality/entanglements and commercial fishing effort trip locations, (II) links to fishery descriptions for Category I, II and some category III fisheries that have documented interactions with marine mammals and their historical level of observer coverage, and (III) historical fishery descriptions.

Part A. Description of U.S. Atlantic Commercial Fisheries

I. Data Sources

Items 1–5 describe sources of marine mammal mortality, serious injury or entanglement data; items 6–9 describe the sources of commercial fishing effort data used to summarize different components of each fishery (i.e. active number of permit holders, total effort, temporal and spatial distribution) and generate maps depicting the location and amount of fishing effort.

1. Northeast Region Fisheries Observer Program (NEFOP)

In 1989, a Fisheries Observer Program was implemented in the Northeast Region (Maine–Rhode Island) to document incidental bycatch of marine mammals in the Northeast Region Multi-species Gillnet Fishery. In 1993, sampling was expanded to observe bycatch of marine mammals in Gillnet Fisheries in the Mid-Atlantic Region (New York–North Carolina). The Northeast Fisheries Observer Program (NEFOP) has since been expanded to sample multiple gear types in both the Northeast and Mid-Atlantic Regions for documenting and monitoring interactions of marine mammals, sea turtles and finfish bycatch attributed to commercial fishing operations. At-sea observers placed onboard commercial fishing vessels collect data on fishing operations, gear and vessel characteristics, kept and discarded catch composition, bycatch of protected species, animal biology, and habitat (NMFS-NEFSC 2020).

2. Southeast Region Fishery Observer Programs

Three Fishery Observer Programs are managed by the Southeast Fisheries Science Center (SEFSC) that observe commercial fishery activity in U.S. Atlantic waters. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992 and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species Fisheries Management Plan (HMS FMP, 50 CFR Part 635). The second program is the Shark Gillnet Observer Program that observes the Southeastern U.S. Atlantic Shark Gillnet Fishery. The Observer Program is mandated under the HMS FMP, the Atlantic Large Whale Take Reduction Plan (ALWTRP; 50 CFR Part 229.32), and the Biological Opinion under Section 7 of the Endangered Species Act. Observers are deployed on any active fishing vessel reporting shark drift gillnet effort. In 2005, this program also began to observe sink gillnet fishing for sharks along the southeastern U.S. coast. The observed fleet includes vessels with an active directed shark permit and fish with sink gillnet gear (Carlson and Bethea 2007). The third program is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer, if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is approximately 1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught.

3. Regional Marine Mammal Stranding Networks

The Northeast and Southeast Region Stranding Networks are components of the Marine Mammal Health and Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). Since 1997, the Northeast Region Marine Mammal Stranding Network has been collecting and storing data on marine mammal strandings and entanglements that occur from Maine through Virginia. The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the Atlantic coast from North Carolina to Florida, along the U.S. Gulf of Mexico coast from Florida through Texas, and in the U.S. Virgin Islands and Puerto Rico. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History, Washington, D.C. Volunteer participants, acting under a letter of agreement, collect data on stranded animals that include: species; event date and location; details of the event (i.e., signs of human interaction) and determination on cause of death; animal disposition; morphology; and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a non-endangered/threatened marine mammal incidental to fishing operations.

These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery, must be prepared to carry a fisheries observer if selected, and must comply with all applicable take reduction plan regulations. All vessel owners, regardless of the category of fishery they are operating in, are required to report, within 48 hours of the incident and even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2019). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting can be done online at:
https://docs.google.com/a/noaa.gov/forms/d/e/1FAIpQLSfKe0moEVK24x1Jbly33A0MRAa2ljZgmAcCVO1hEXghtB3SYA/viewform

5. Other Data Sources for Protected Species Interactions/Entanglements/Ship Strikes

In addition to the above, data on fishery interactions/entanglements and vessel collisions with large cetaceans are reported from a variety of other sources including the New England Aquarium (Boston, Massachusetts); Provincetown Center for Coastal Studies (Provincetown, Massachusetts); U.S. Coast Guard; whale watch vessels; Canadian Department of Fisheries and Oceans (DFO); and members of the Atlantic Large Whale Disentanglement Network. These data, photographs, etc. are maintained by the Protected Species Division at the Greater Atlantic Regional Fisheries Office (GARFO), the Protected Species Branch at the Northeast Fisheries Science Center (NEFSC) and the Southeast Fisheries Science Center (SEFSC).

6. Northeast Region Vessel Trip Reports

The Northeast Region Vessel Trip Report Data Collection System is a mandatory, but self-reported, commercial fishing effort database (Wigley *et al.* 1998). The data collected include: species kept and discarded, gear types used, trip location, trip departure and landing dates, port, and vessel and gear characteristics. The reporting of these data is mandatory only for vessels fishing under a federal permit. Vessels fishing under a federal permit are required to report in the Vessel Trip Report even when they are fishing within state waters.

7. Southeast Region Fisheries Logbook System

The Fisheries Logbook System (FLS) is maintained at the SEFSC and manages data submitted from mandatory Fishing Vessel Logbook Programs under several FMPs. In 1986, a comprehensive logbook program was initiated for the Large Pelagics Longline Fishery and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the 1990s for a number of other fisheries including: Reef Fish Fisheries, Snapper-Grouper Complex Fisheries, federally managed Shark Fisheries, and King and Spanish Mackerel Fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimates of the total incidental take of marine mammal species in a given fishery. More information is available at: https://www.fisheries.noaa.gov/southeast/resources-fishing/southeast-fisheries-permits

8. Northeast Region Dealer Reported Data

The Northeast Region Dealer Database houses trip level fishery statistics on fish species landed by market category, vessel ID, permit number, port location and date of landing, and gear type utilized. The data are collected by both federally permitted seafood dealers and NMFS port agents. Data are considered to represent a census of both vessels actively fishing with a federal permit and total fish landings. It also includes vessels that fish with a state permit (excluding the state of North Carolina) that land a federally managed species. Some states submit the same trip level data to the Northeast Region, but contrary to the data submitted by federally permitted seafood dealers, the trip level data reported by individual states does not include unique vessel and permit information. Therefore, the estimated number of active permit holders reported within this appendix should be considered a minimum estimate. It is important to note that dealers were previously required to report weekly in a dealer call-in system. However, in recent years the NER regional dealer reporting system has instituted a daily electronic reporting system. Although the initial reports generated from this new system did experience some initial reporting problems, these problems have been addressed and the new daily electronic reporting system is providing better real time information to managers.

9. Northeast At-Sea Monitoring Program

At-sea monitors collect scientific, management, compliance, and other fisheries data onboard commercial fishing vessels through interviews of vessel captains and crew, observations of fishing operations, photographing catch, and measurements of selected portions of the catch and fishing gear. At-sea monitoring requirements are detailed under Amendment 16 to the NE Multispecies Fishery Management Plan with a planned implementation date of May 1st, 2010. At-sea monitoring coverage is an integral part of catch monitoring to ensure that Annual Catch Limits are not exceeded. At-sea monitors collect accurate information on catch composition and the data are used to estimate total discards by sectors (and common pool), gear type, and stock area. Coverage levels are expected around 30%.

II. Marine Mammal Protection Act's List of Fisheries

The List of Fisheries (LOF) classifies U.S. commercial fisheries into one of three Categories according to the level of incidental mortality or serious injury of marine mammals:

Category I: Frequent incidental mortality or serious injury of marine mammals

Category II: Occasional incidental mortality or serious injury of marine mammals
Category III: Remote likelihood of/no known incidental mortality or serious injury of marine mammals

The Marine Mammal Protection Act (MMPA) mandates that each fishery be classified by the level of mortality or serious injury and mortality of marine mammals that occurs incidental to each fishery as reported in the annual Marine Mammal Stock Assessment Reports for each stock. A fishery may qualify as one Category for one marine mammal stock and another Category for a different marine mammal stock. A fishery is typically categorized on the LOF according to its highest level of classification (e.g., a fishery that qualifies for Category III for one marine mammal stock and Category II for another marine mammal stock will be listed under Category II). The fisheries listed below are linked to classification based on the most current LOF published in the *Federal Register*.

III. U.S Atlantic Commercial Fisheries

Please see the List of Fisheries for more information on the following fisheries: Northeast Sink Gillnet, Northeast Anchored Float Gillnet Fishery, Northeast Drift Gillnet Fishery, Mid-Atlantic Gillnet, Mid-Atlantic Bottom Trawl, Northeast Bottom Trawl, Northeast Mid-Water Trawl Fishery (includes pair trawls), Mid-Atlantic Mid-Water Trawl Fishery (includes pair trawls), Bay of Fundy Herring Weir, Gulf of Maine Atlantic Herring Purse Seine Fishery, Northeast/Mid-Atlantic American Lobster Trap/Pot, Atlantic Mixed Species Trap/Pot Fishery, Atlantic Ocean/Caribbean/Gulf of Mexico Large Pelagics Longline, Southeast Atlantic Gillnet, Southeastern U.S. Atlantic Shark Gillnet Fishery, Atlantic Blue Crab Trap/Pot, Mid-Atlantic Haul/Beach Seine, North Carolina Inshore Gillnet Fishery, North Carolina Long Haul Seine, North Carolina Roe Mullet Stop Net, Virginia Pound Net, Mid-Atlantic Menhaden Purse Seine, Southeastern U.S. Atlantic/Gulf of Mexico Shrimp Trawl, and Southeastern U.S. Atlantic/Gulf of Mexico Stone Crab Trap/Pot Fishery.

IV. Historical Fishery Descriptions

Atlantic Foreign Mackerel

Prior to 1977, there was no documentation of marine mammal bycatch in Distant-Water Fishing (DWF) activities off the Northeast coast of the U.S. In 1977, with implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA), an Observer Program was established which recorded fishery data and information on incidental bycatch of marine mammals. DWF effort in the U.S. Atlantic Exclusive Economic Zone (EEZ) under MFCMA had been directed primarily towards Atlantic mackerel and squid. From 1977 through 1982, an average mean of 120 different foreign vessels per year (range 102–161) operated within the U.S. Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18 vessels, were Japanese tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the U.S. Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9, respectively. Between 1983 and 1988, the numbers of DWF Japanese longline vessels included 3, 5, 7, 6, 8, and 8, respectively. Observer coverage on DWF vessels was 25-35% during 1977-1982, and increased to 58%, 86%, 95% and 98%, respectively, in 1983–1986. One hundred percent observer coverage was maintained during 1987–1991. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and for mackerel at the end of the 1991 season. Documented interactions with white-sided dolphins were reported in this fishery.

Pelagic Drift Gillnet

In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. The fishery operated during 1998. Then, in January 1999 NMFS issued a Final Rule to prohibit the use of drift net gear in the North Atlantic Swordfish Fishery (50 CFR Part 630). In 1986, NMFS established a mandatory self-reported fisheries information system for Large Pelagic Fisheries. Data files are maintained at the SEFSC. The estimated total number of hauls in the Atlantic Pelagic Drift Gillnet Fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls from 1991 to 1996 was 233, 243, 232, 197, 164, and 149, respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. In 1994 to 1998 there were 11, 12, 10, 0, and 11 vessels, respectively, in the fishery. Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, 64% in 1996, no fishery in 1997, and 99% coverage during 1998. Observer coverage dropped during 1996 because some vessels were deemed too small or unsafe by the contractor that provided observer coverage to NMFS. Fishing effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras, North Carolina. Examination of the species composition of the catch and locations of the fishery throughout the year suggest that the Drift Gillnet Fishery was stratified into two strata: (1) a southern, or winter, stratum and (2) a northern, or summer, stratum. Documented interactions with North Atlantic right whales, humpback whales, sperm whales, pilot whale spp., *Mesoplodon* spp., Risso's dolphins, common dolphins, striped dolphins and white-sided dolphins were reported in this fishery.

Atlantic Tuna Purse Seine

The Tuna Purse Seine Fishery occurring between the Gulf of Maine and Cape Hatteras, North Carolina is directed at large medium and giant bluefin tuna (BFT). Spotter aircraft are typically used to locate fish schools. The official start date, set by regulation, is 15 July of each year. Individual Vessel Quotas (IVQs) and a limited access system prevent a derby fishery situation. Catch rates for large medium, and giant tuna can be high and consequently, the season can last only a few weeks, however, over the last number of years, effort expended by this sector of the BFT fishery has diminished dramatically due to the unavailability of BFT on the fishing grounds.

The regulations allocate approximately 18.6% of the U.S. BFT quota to this sector of the fishery (five IVQs) with a tolerance limit established for large medium BFT (15% by weight of the total amount of giant BFT landed).

Limited observer data is available for the Atlantic Tuna Purse Seine Fishery. Out of 45 total trips made in 1996, 43 trips (95.6%) were observed. Forty-four sets were made on the 43 observed trips and all sets were observed. A total of 136 days were covered. No trips were observed during 1997 through 1999. Two trips (seven hauls) were observed in October 2000 in the Great South Channel Region. Four trips were observed in September 2001. No marine mammals were observed taken during these trips. Documented interactions with pilot whale spp. were reported in this fishery.

Atlantic Tuna Pelagic Pair Trawl

The Pelagic Pair Trawl Fishery operated as an experimental fishery from 1991 to 1995, with an estimated 171 hauls in 1991, 536 in 1992, 586 in 1993, 407 in 1994, and 440 in 1995. This fishery ceased operations in 1996 when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in the Atlantic Tuna Fishery. The fishery operated from August to November in 1991, from June to November in 1992, from June to October in 1993 (Northridge 1996), and from mid-summer to December in 1994 and 1995. Sea sampling began in October of 1992 (Gerrior *et al.* 1994) where 48 sets (9% of the total) were sampled. In 1993, 102 hauls (17% of the total) were sampled. In 1994 and 1995, 52% (212) and 55% (238), respectively, of the sets were observed. Nineteen vessels have operated in this fishery. The fishery operated in the area between 35°N to 41°N and 69°W to 72°W. Approximately 50% of the total effort was within a one degree square at 39°N, 72°W, around Hudson Canyon, from 1991 to 1993. Examination of the 1991–1993 locations and species composition of the bycatch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). During the 1994 and 1995 Experimental Pelagic Pair Trawl Fishing Seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudey 1995, 1996), but the results were inconclusive. Documented interactions with pilot whale spp., Risso's dolphin and common dolphins were reported in this fishery.

Part B. Description of U.S. Gulf of Mexico Fisheries

I. Data Sources

Items 1 and 2 describe sources of marine mammal mortality, serious injury or entanglement data, and item 3 describes the source of commercial fishing effort data used to generate maps depicting the location and amount of fishing effort and the numbers of active permit holders. In general, commercial fisheries in the Gulf of Mexico have had little directed observer coverage and the level of fishing effort for most fisheries that may interact with marine mammals is either not reported or highly uncertain.

1. Southeast Region Fishery Observer Programs

Two fishery observer programs are managed by the SEFSC that observe commercial fishery activity in the U.S. Gulf of Mexico. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992, and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species FMP (HMS FMP, 50 CFR Part 635). The second is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is ~1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught.

2. Regional Marine Mammal Stranding Networks

The Southeast Regional Stranding Network is a component of the Marine Mammal Health and Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the U.S. Gulf of Mexico coast from Florida through Texas. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History. Volunteer participants, acting under a letter of agreement with NOAA Fisheries, collect data on stranded animals that include: species, event date and location, details of the event including evidence of human interactions, determinations of the cause of death, animal disposition, morphology, and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

3. Southeast Region Fisheries Logbook System (FLS)

The FLS is maintained at the SEFSC and manages data submitted from mandatory fishing vessel logbook programs under several FMPs. In 1986, a comprehensive logbook program was initiated for the Large Pelagics Longline Fisheries, and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the early 1990s for a number of other fisheries including: Reef Fish Fisheries, Snapper-Grouper Complex Fisheries, federally managed Shark Fisheries, and King and Spanish Mackerel Fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimate the total incidental take of marine mammal species in a given fishery.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a non-endangered/threatened marine mammal incidental to fishing operations. These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery, must be prepared to carry a fisheries observer if selected, and must comply with all applicable take reduction plan regulations. All vessel owners, regardless of the category of fishery they are operating in, are required to report within 48 hours of the incident, even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2019). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting can be done online at: https://docs.google.com/a/noaa.gov/forms/d/e/1FAIpQLSfKe0moEVK24x1Jbly33A0MRAa2ljZgmAcCVO1hEXghtB3SYA/viewform

II. Gulf of Mexico Commercial Fisheries

Please see the List of Fisheries for more information on the following fisheries: Spiny Lobster Trap/Pot Fishery, Southeastern U.S. Atlantic/Gulf of Mexico Stone Crab Trap/Pot Fishery, Gulf of Mexico Menhaden Purse Seine Fishery, Gulf of Mexico Gillnet Fishery.

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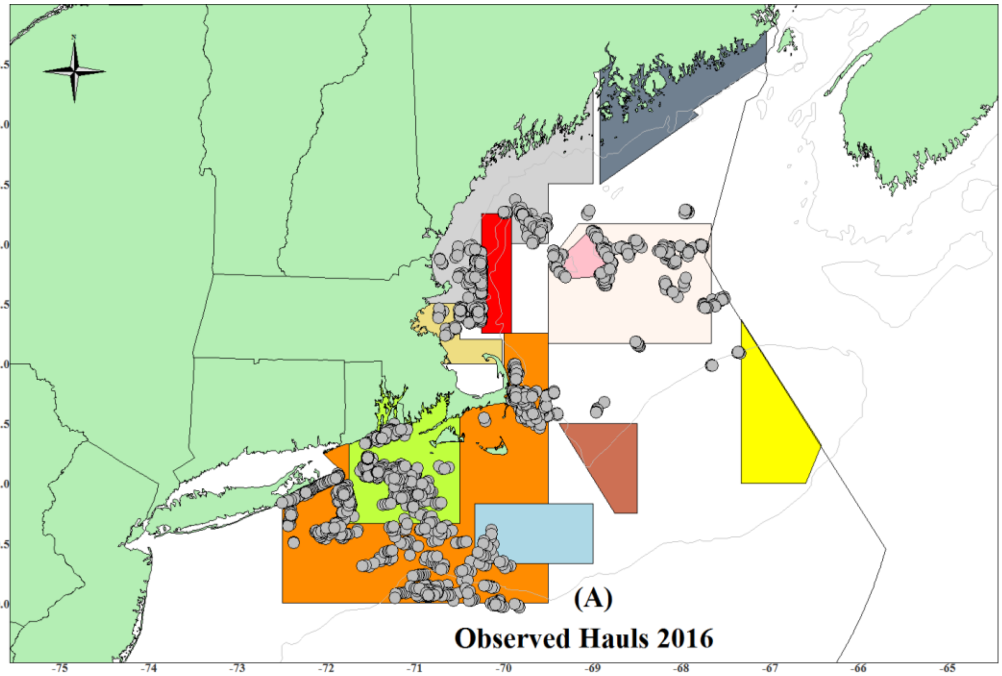
Appendix III: Fishery Descriptions - List of Figures

Figure 1. 2016 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:

Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closed Area

Harbor porpoise Take Reduction Plan management areas:

Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cod South Closure | Cashes Ledge Closed Area

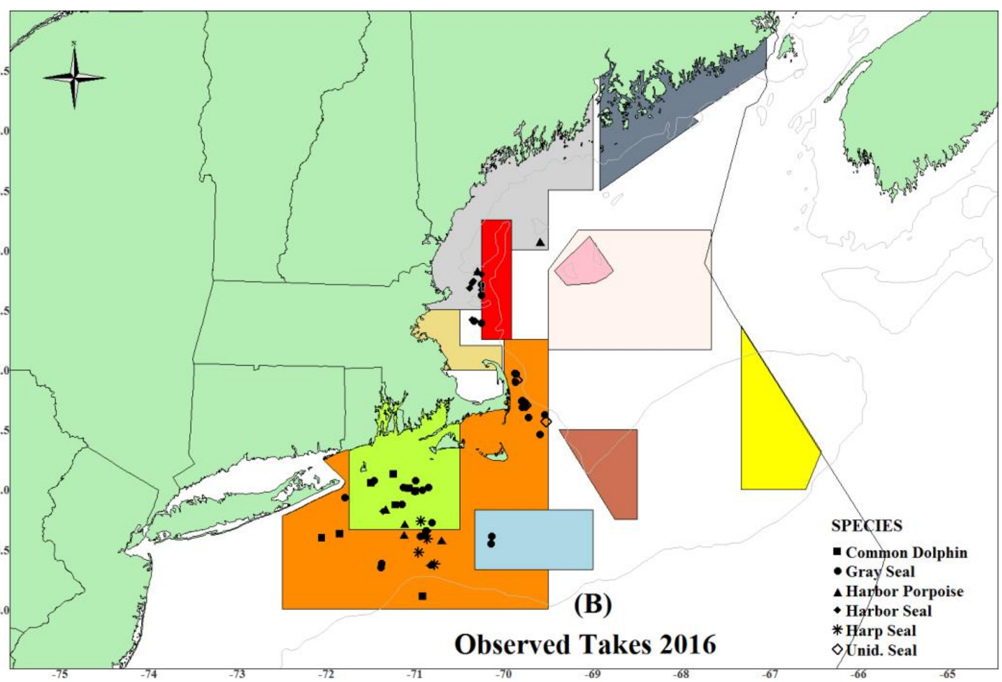
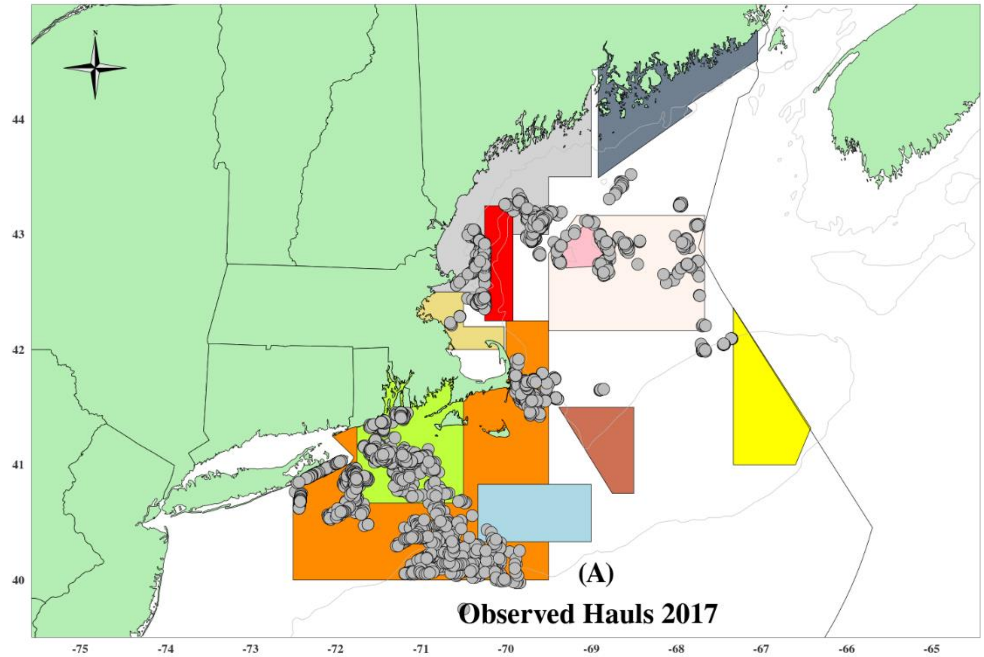


Figure 2. 2017 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:

Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closed Area

Harbor porpoise Take Reduction Plan management areas:

Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cod South Closure | Cashes Ledge Closed Area

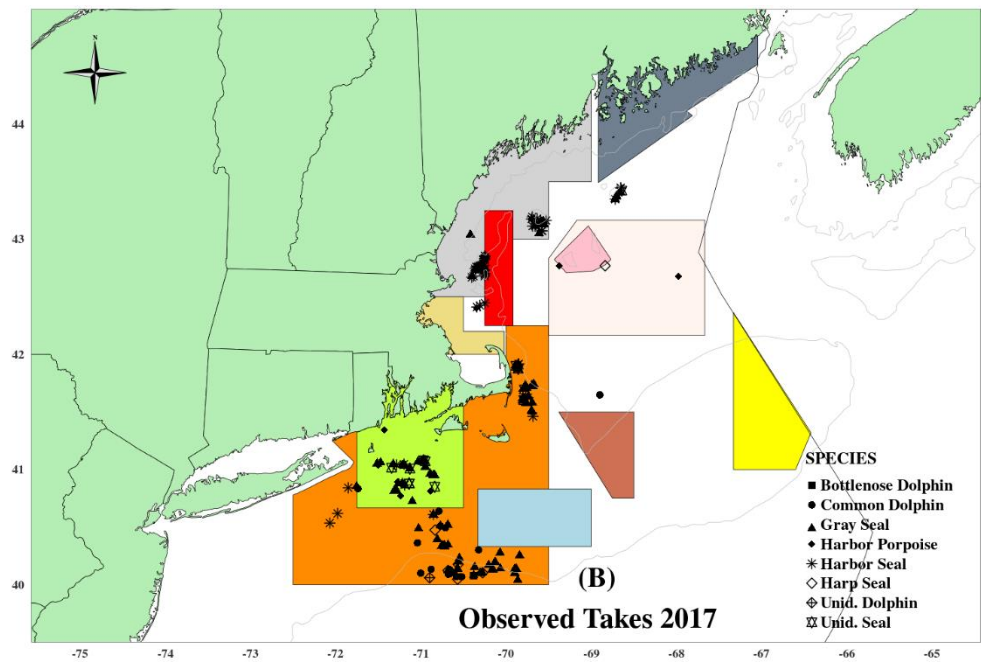
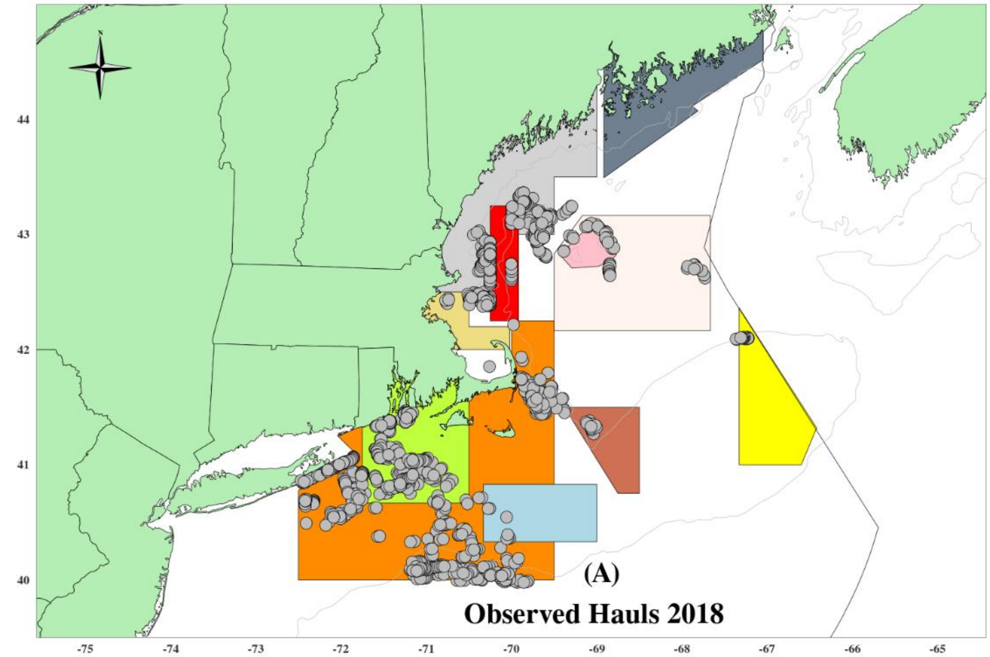


Figure 3. 2018 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:
Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closed Area
Harbor porpoise Take Reduction Plan management areas:
Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cod South Closure | Cashes Ledge Closed Area

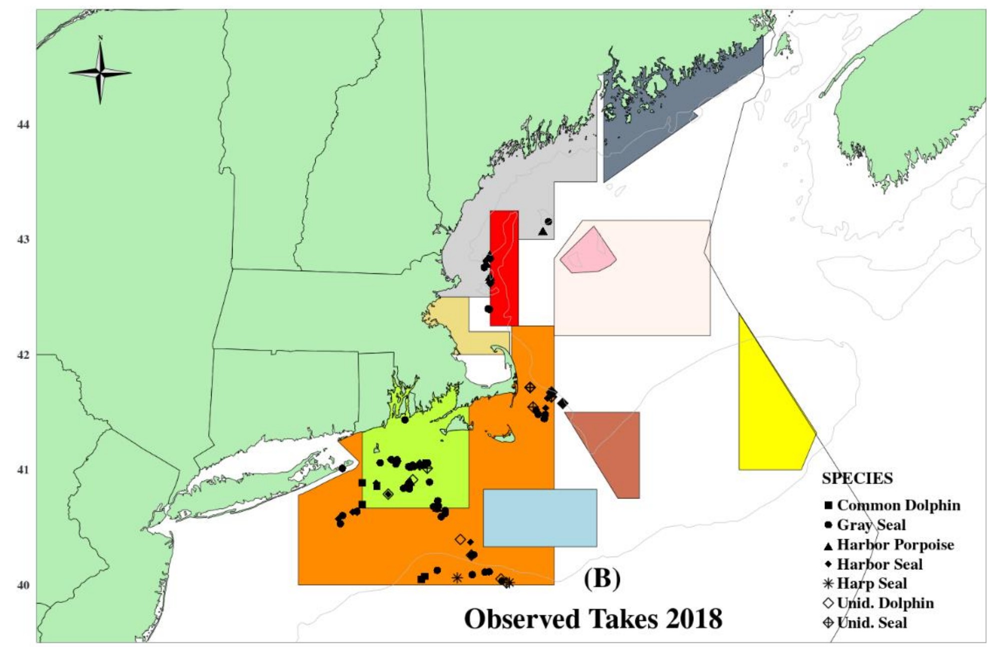
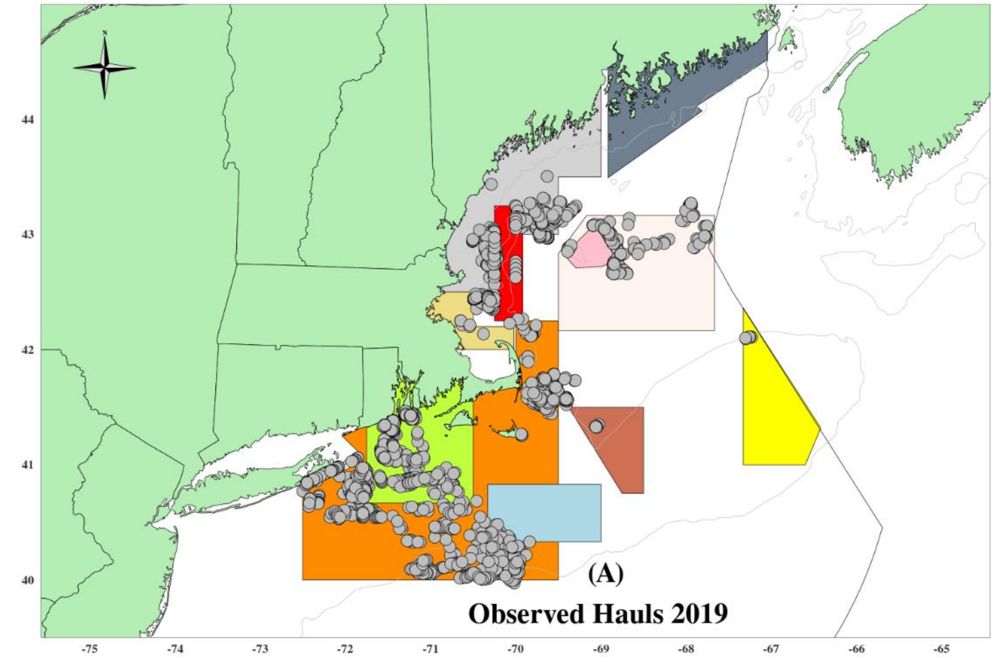


Figure 4. 2019 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:

Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closed Area

Harbor porpoise Take Reduction Plan management areas:

Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cod South Closure | Cashes Ledge Closed Area

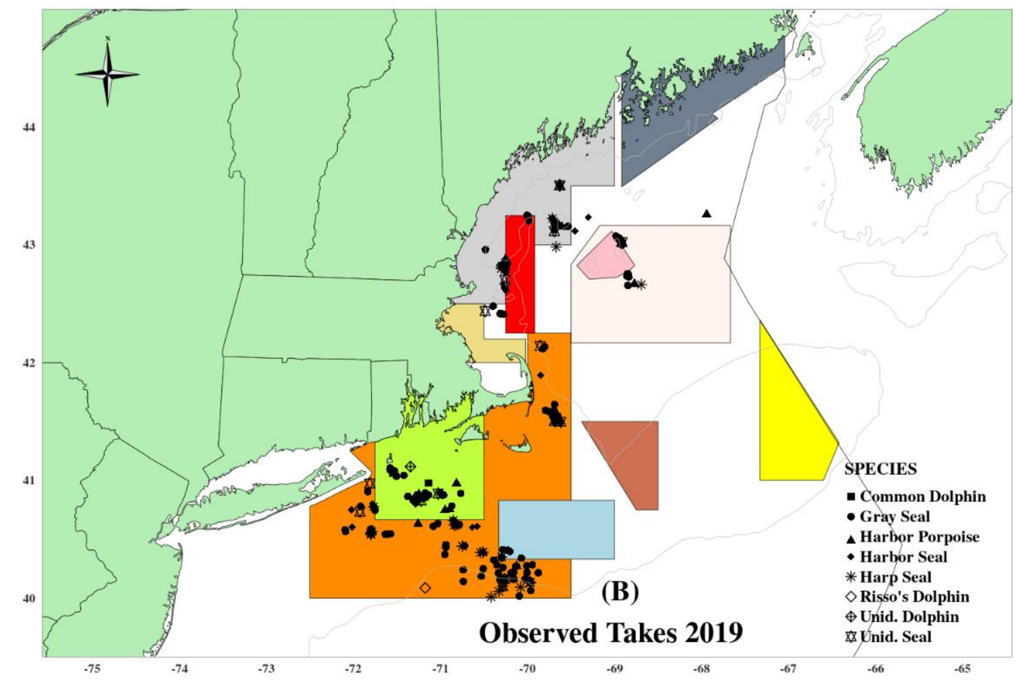
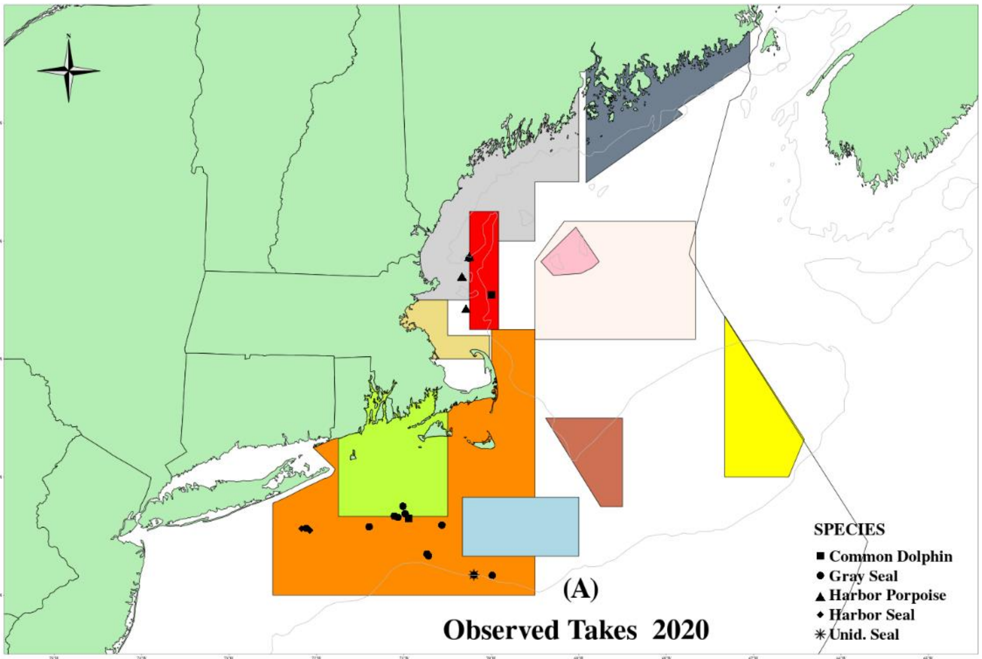


Figure 5. 2020 Northeast sink gillnet observed hauls (A) and observed takes (B).



Multispecies Fisheries Management Plan year-round closures:
Closed Area 1 | Closed Area 2 | Western Gulf of Maine Closed Area | Nantucket Lightship Closed Area | Cashes Ledge Closed Area
Harbor porpoise Take Reduction Plan management areas:
Offshore Closure | Northeast Closure | MidCoast Closure | Mass Bay Closure | Cod South Closure | Cashes Ledge Closed Area

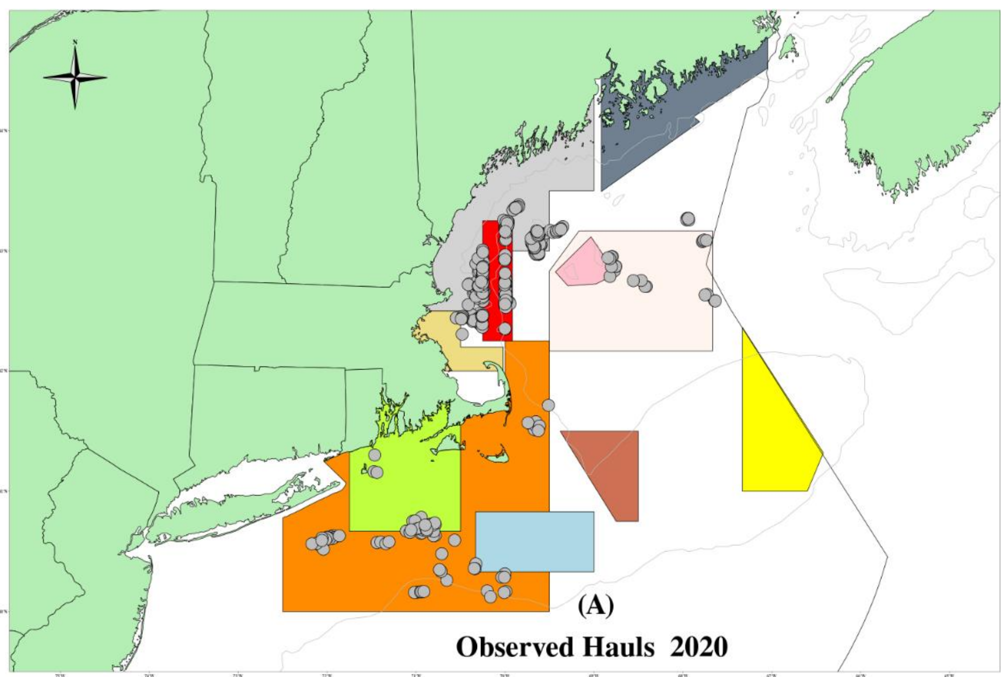
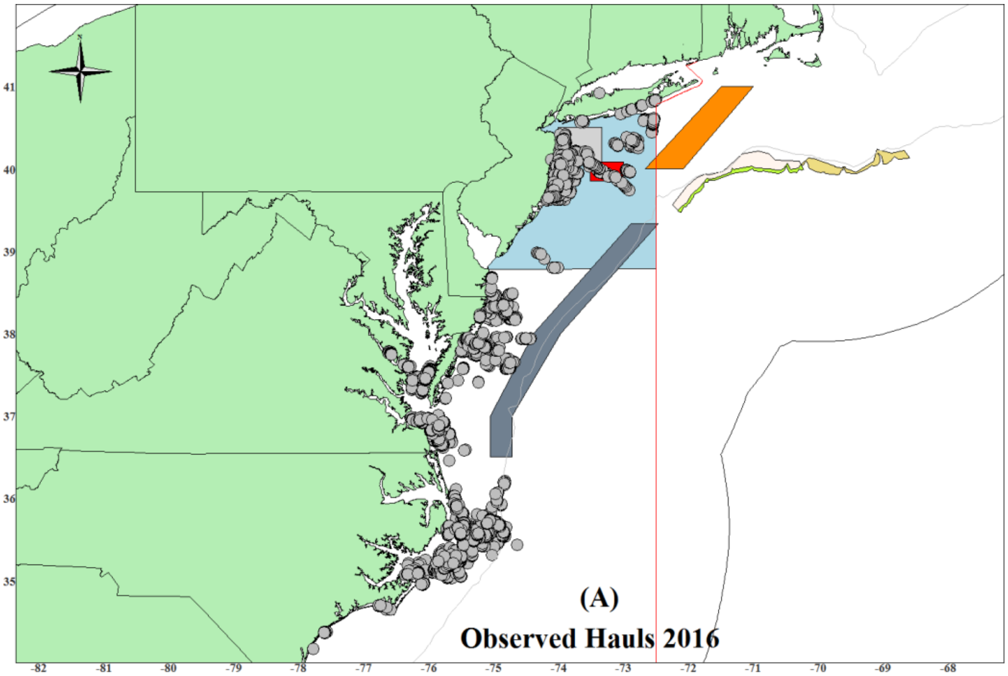


Figure 6. 2016 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | Mudhole South | waters off New Jersey

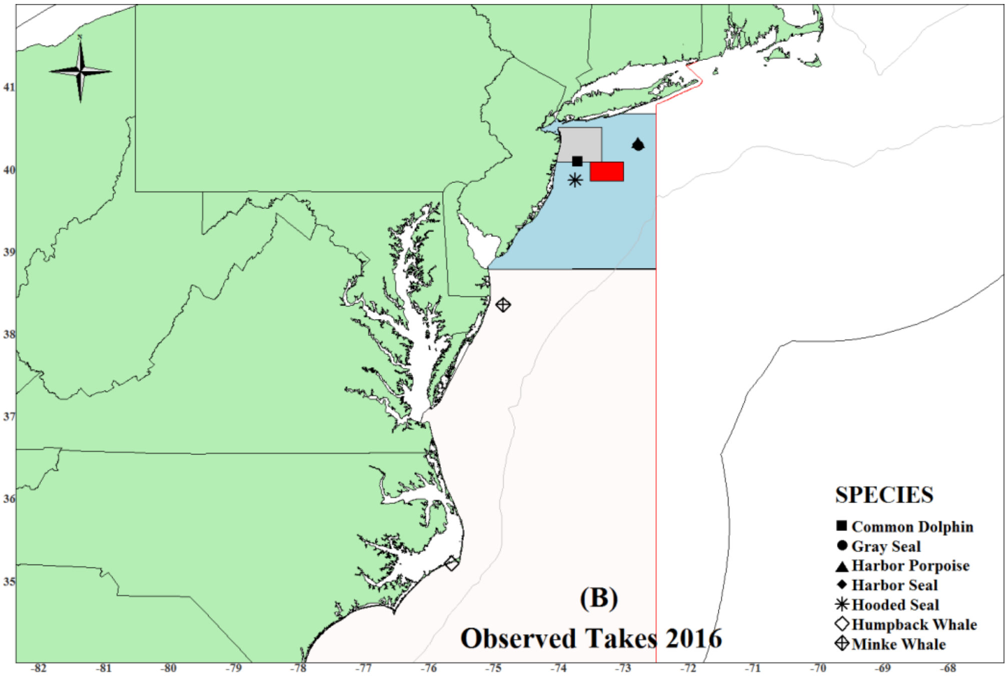
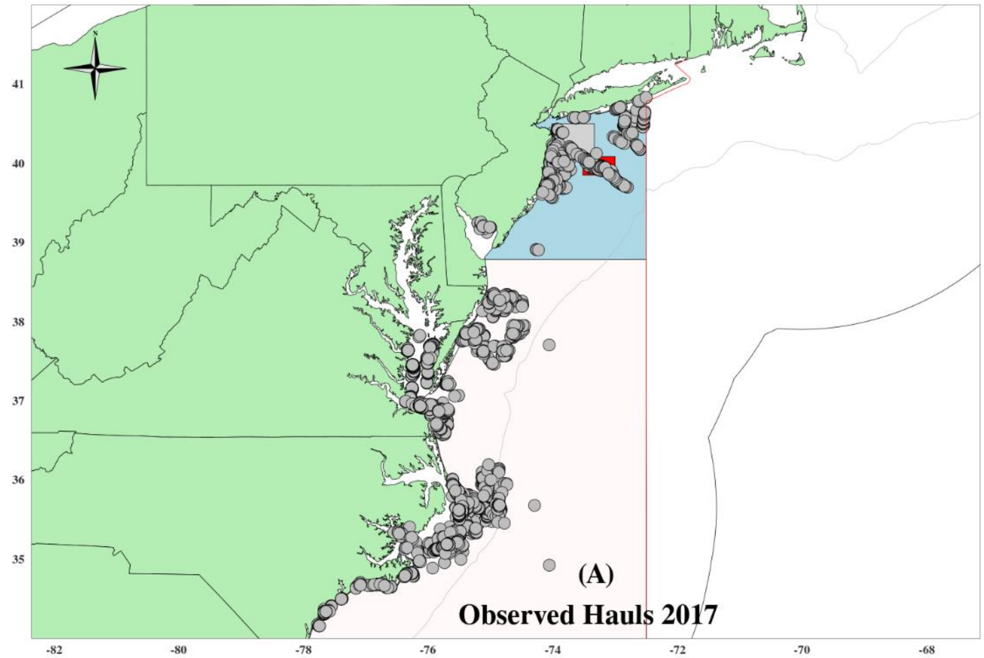


Figure 7. 2017 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | Mudhole South | waters off New Jersey

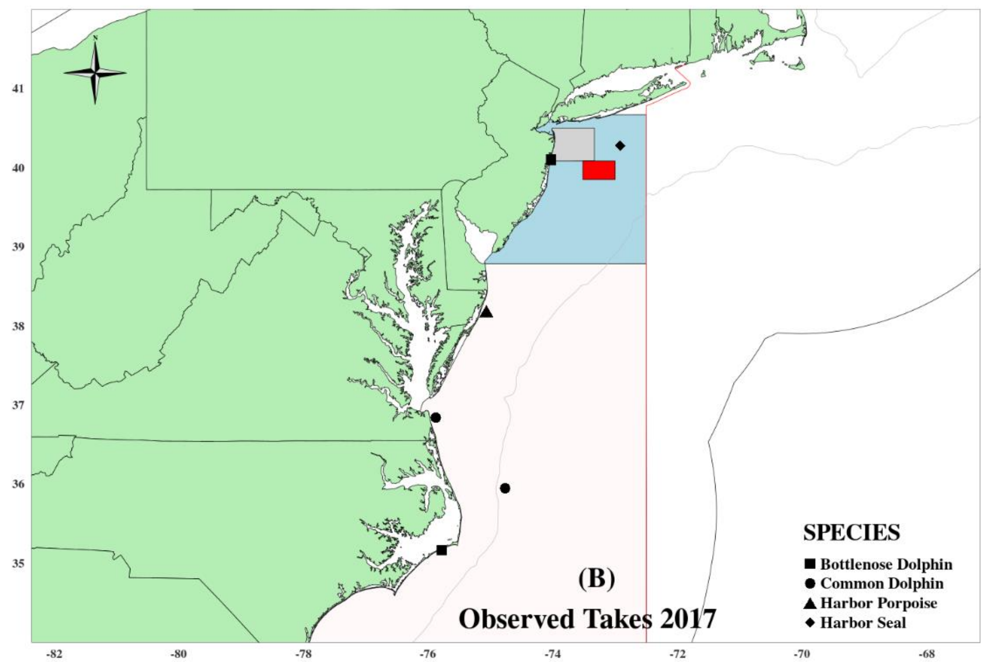
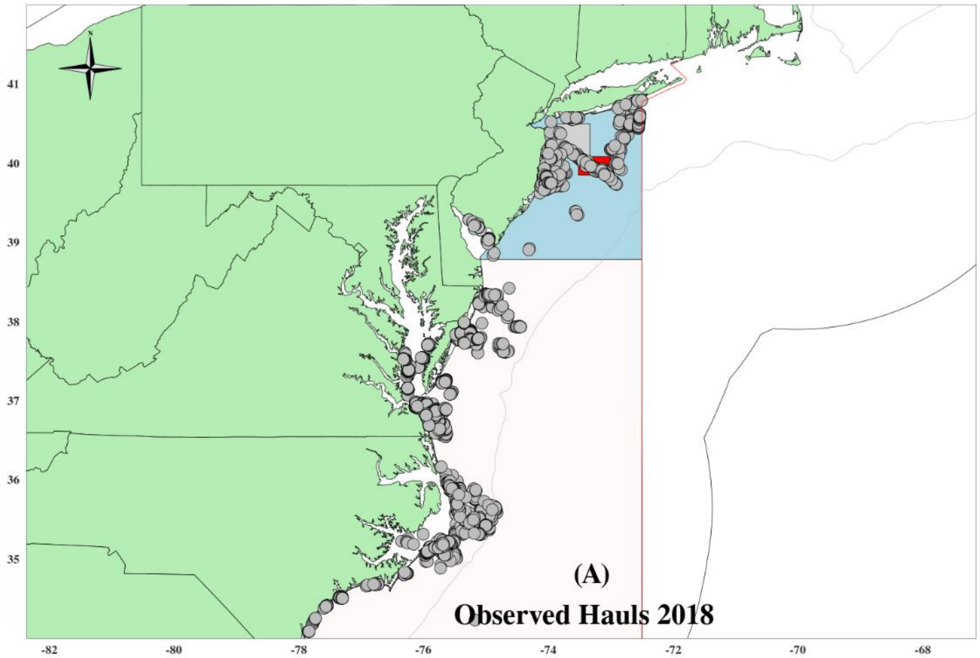


Figure 8. 2018 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | Mudhole South | waters off New Jersey

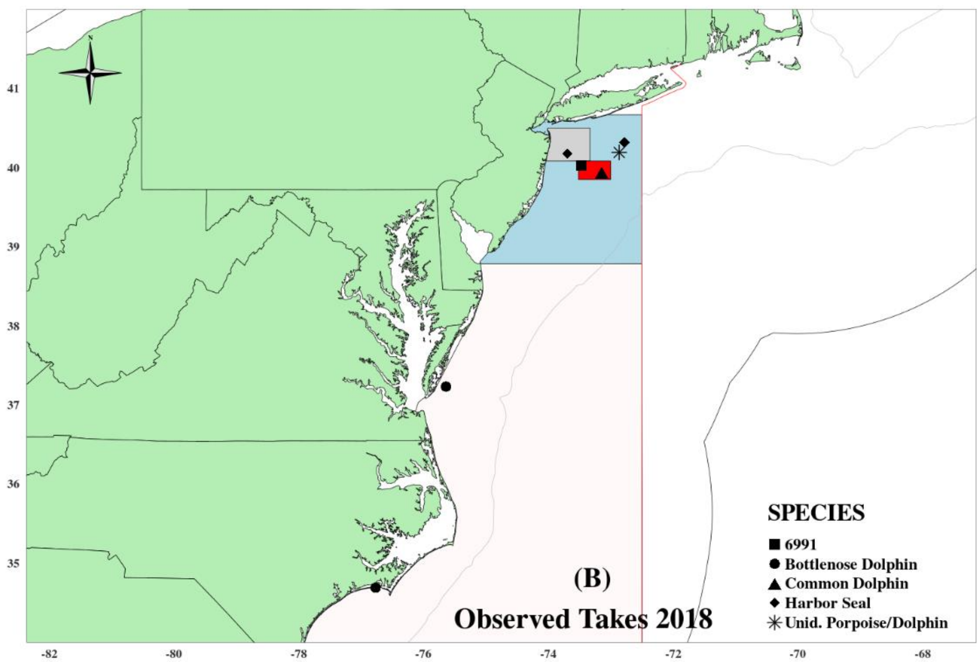
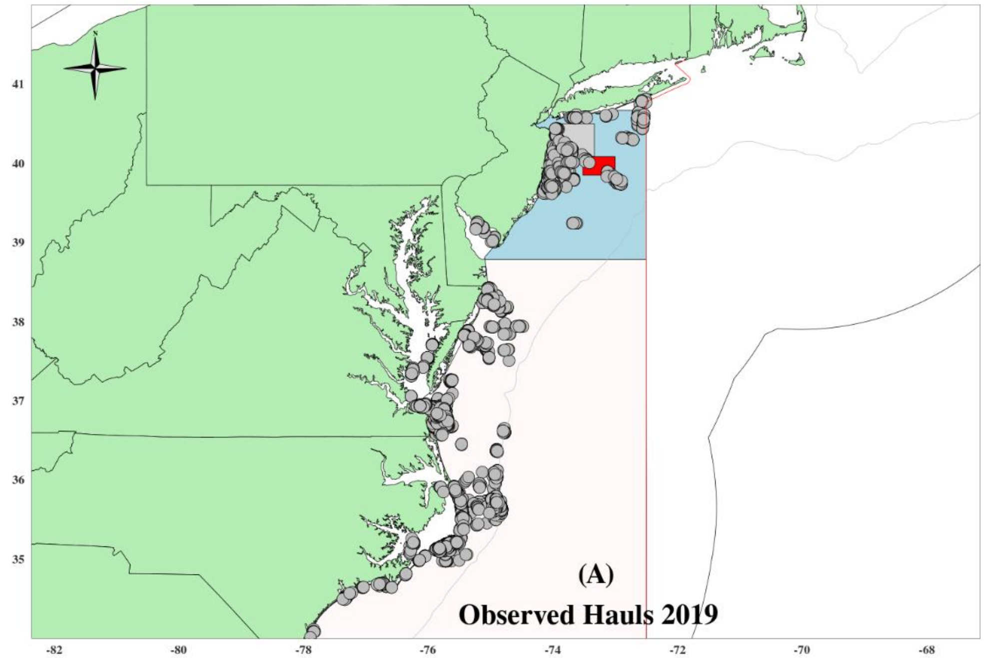


Figure 9. 2019 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | Mudhole South | waters off New Jersey

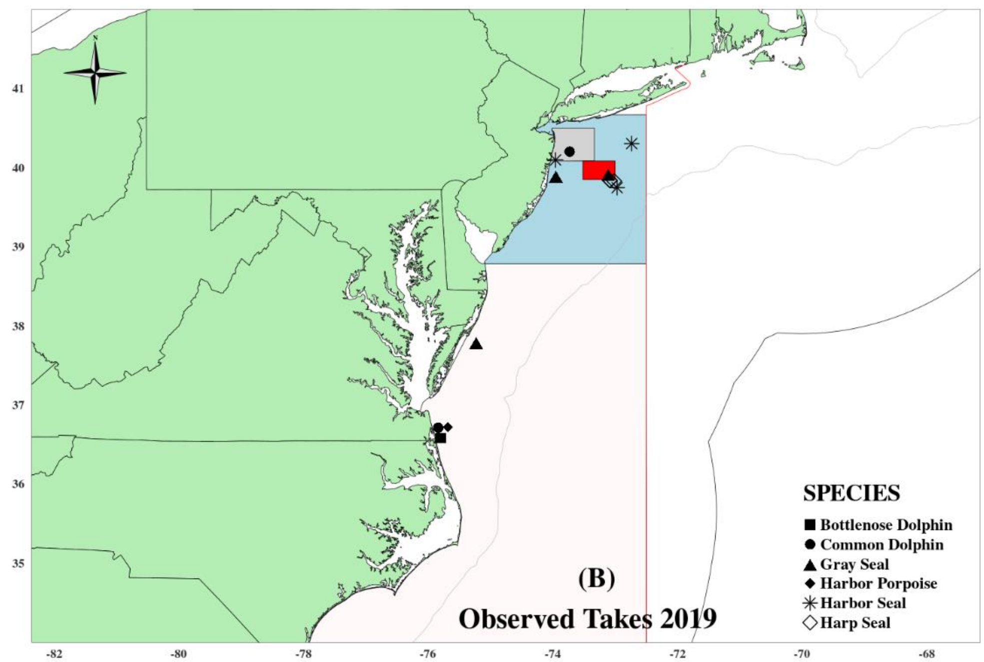
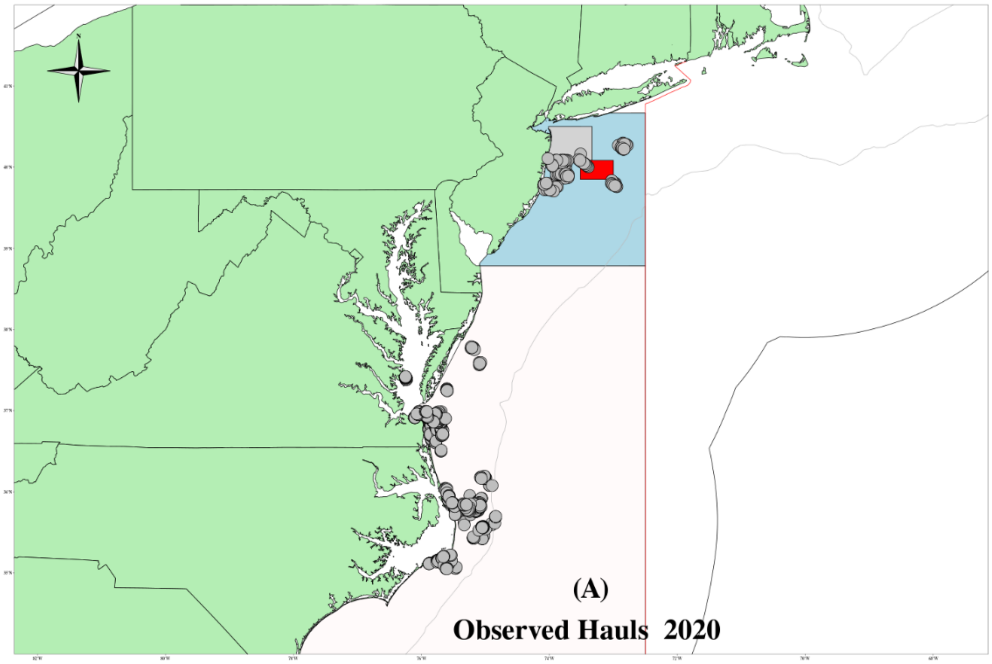


Figure 10. 2020 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:
Southern mid-Atlantic waters | New Jersey Mudhole | Mudhole South | waters off New Jersey

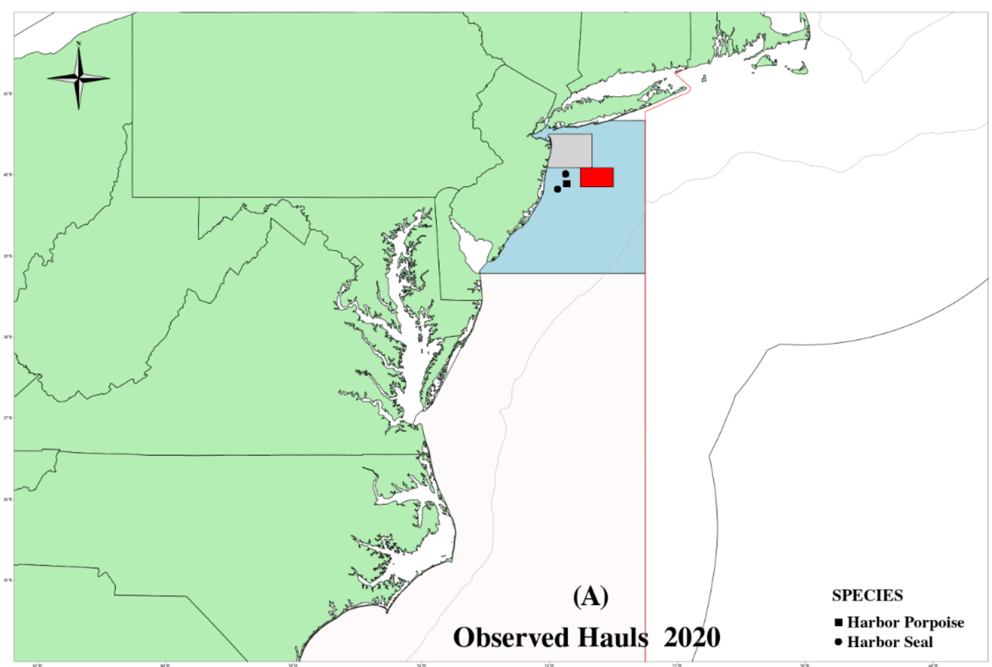


Figure 11. 2016 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

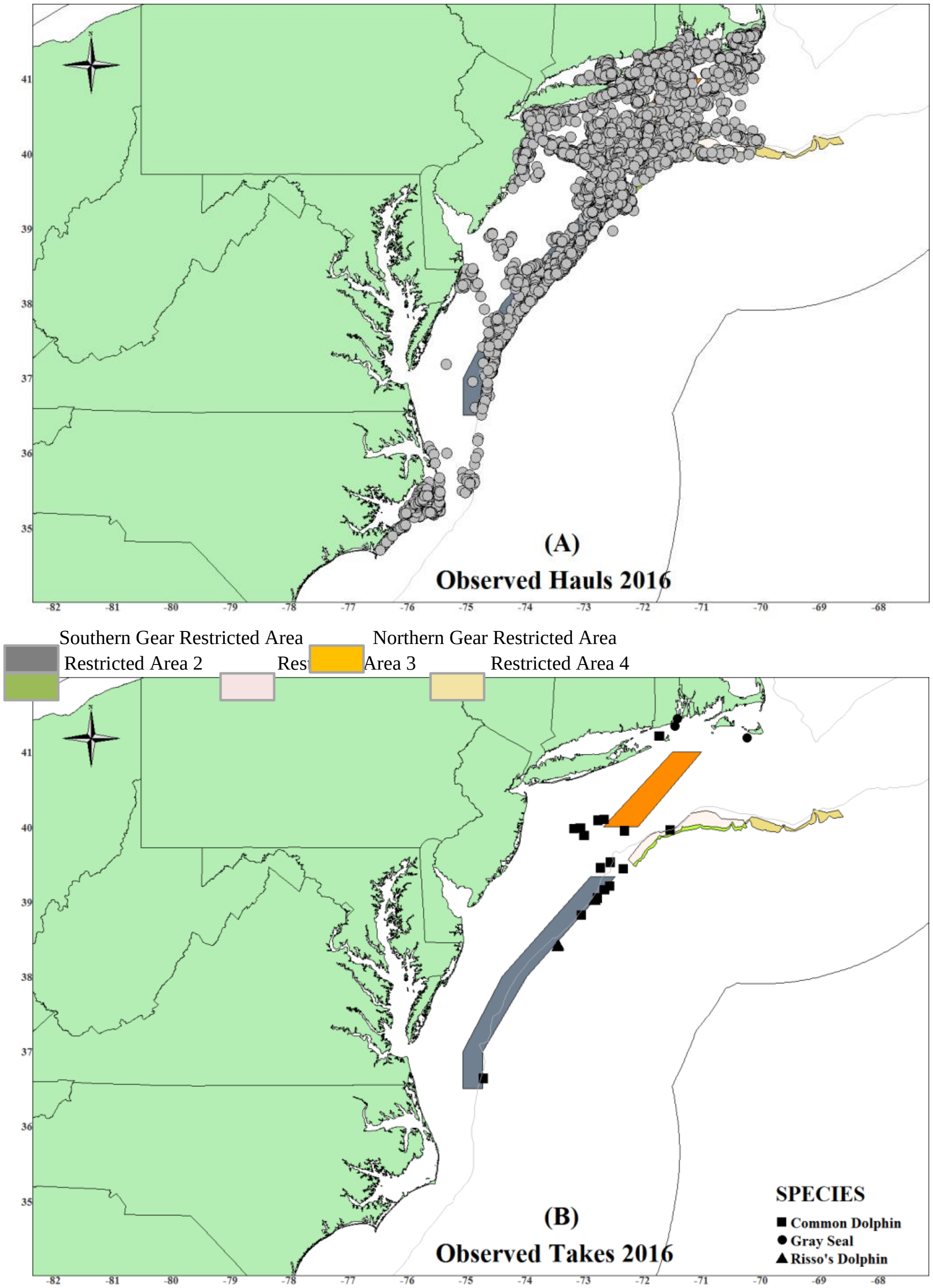


Figure 12. 2017 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

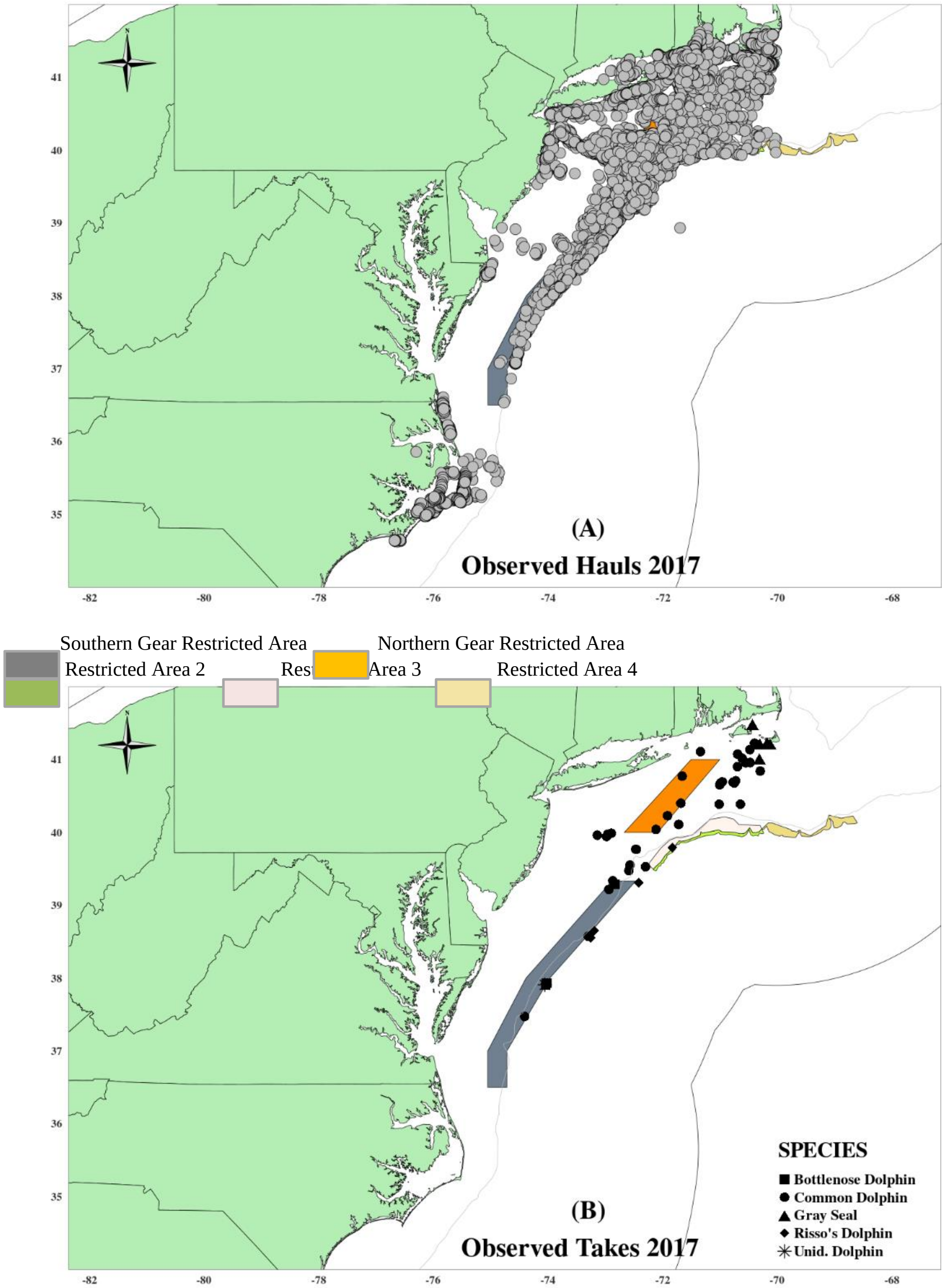


Figure 13. 2018 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

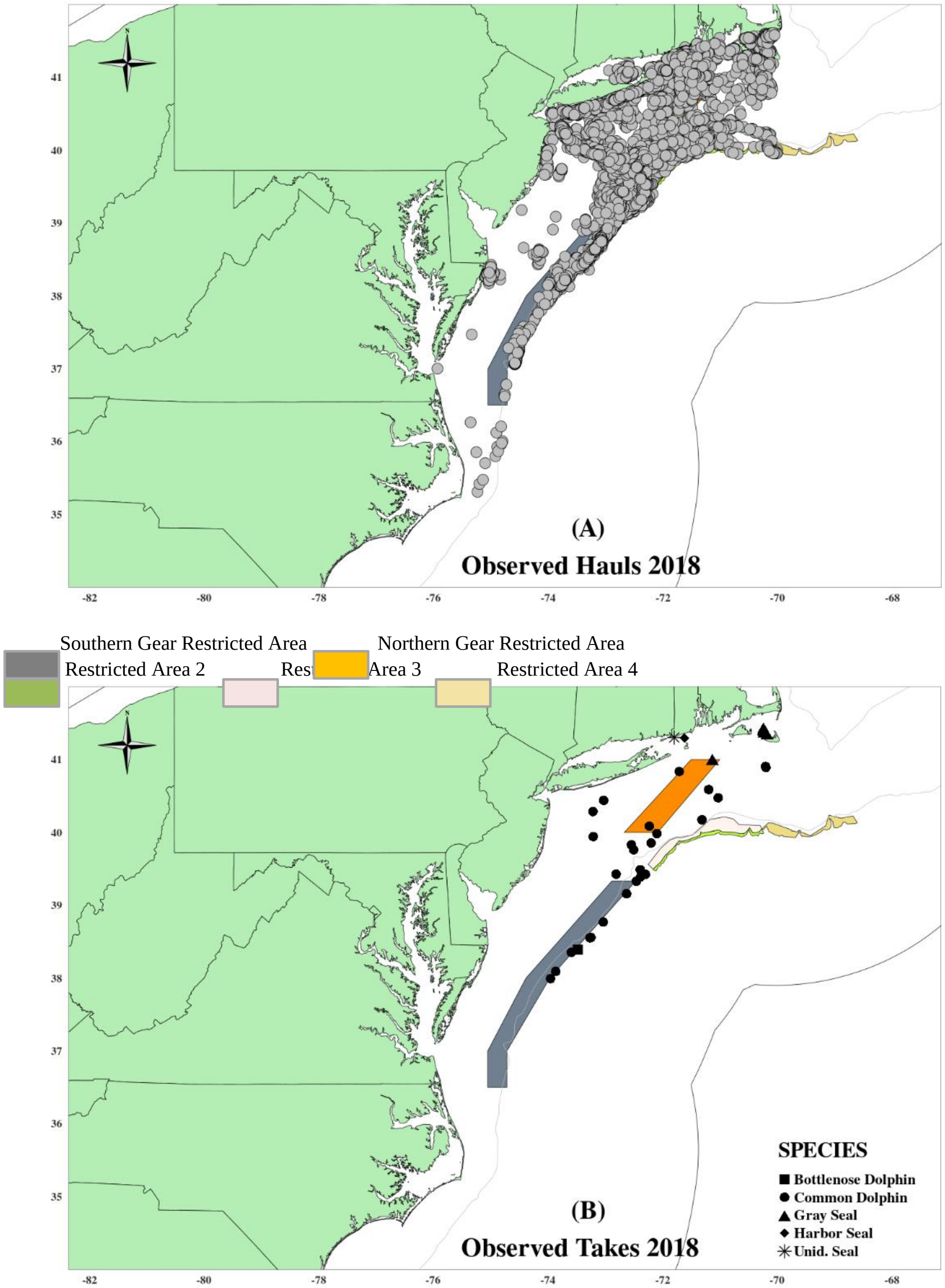


Figure 14. 2019 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

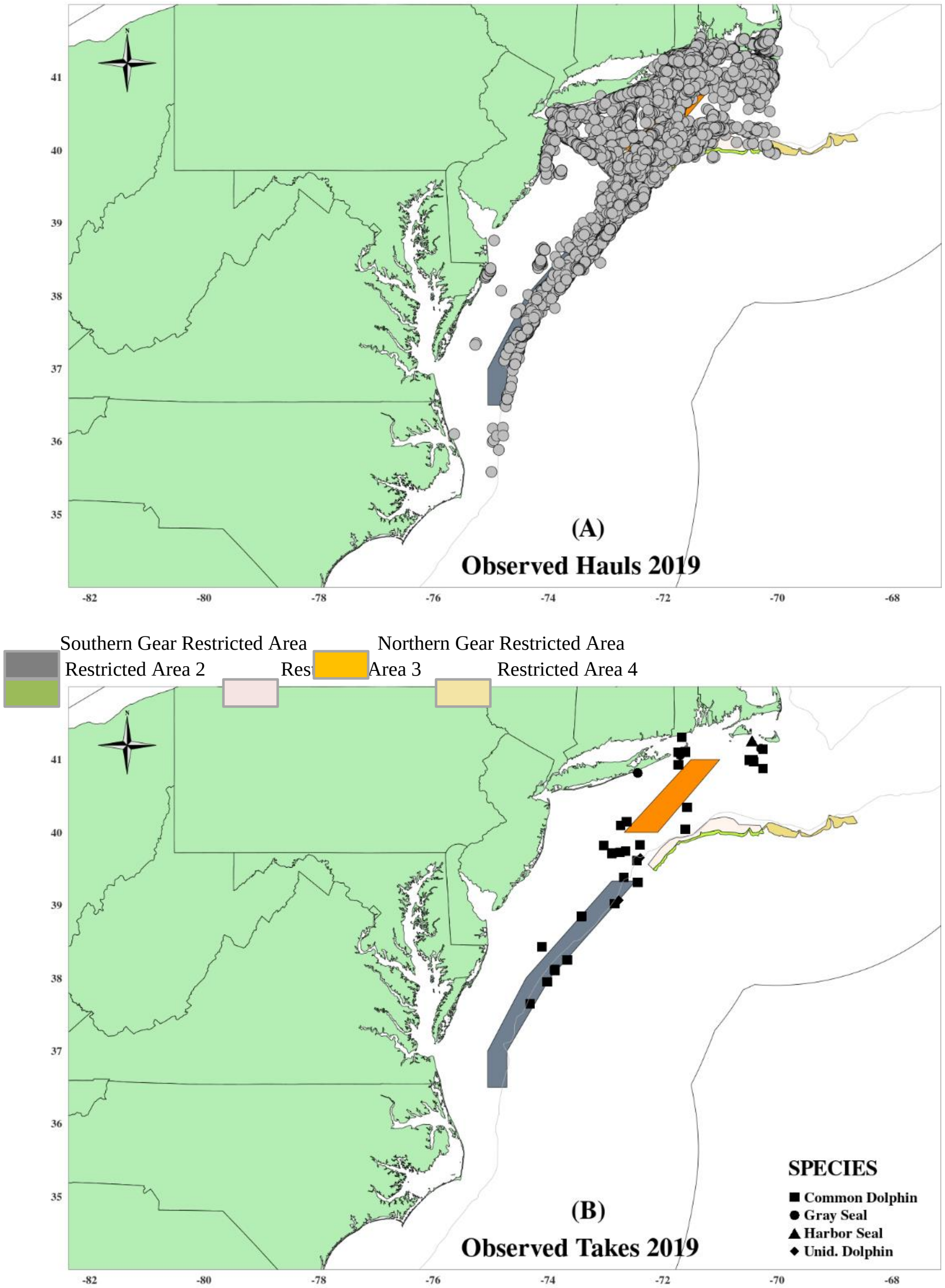
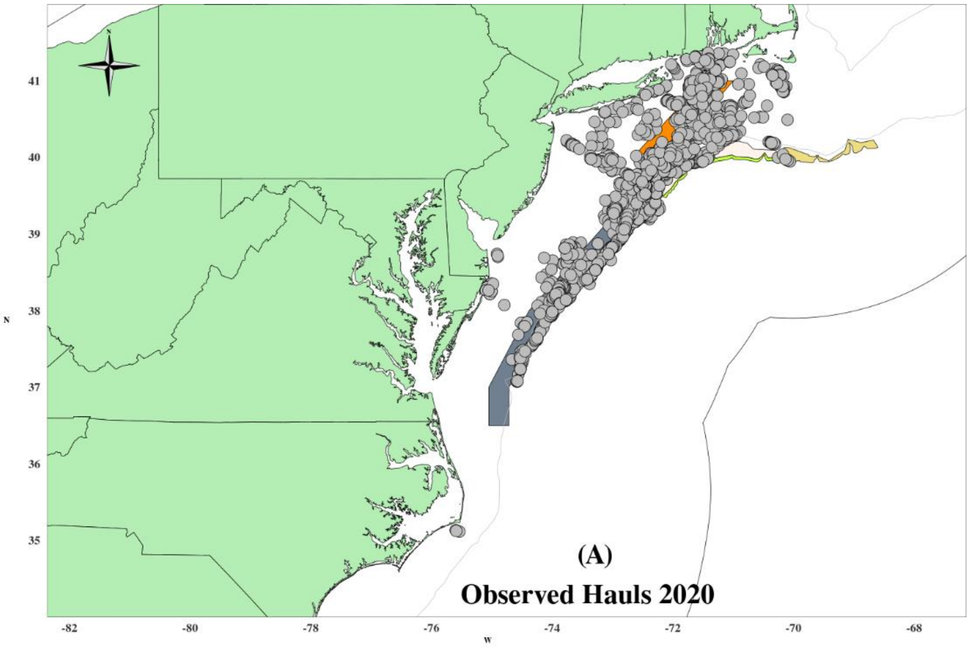


Figure 15. 2020 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).



Southern Gear Restricted Area Northern Gear Restricted Area
Restricted Area 2 Res: Area 3 Restricted Area 4

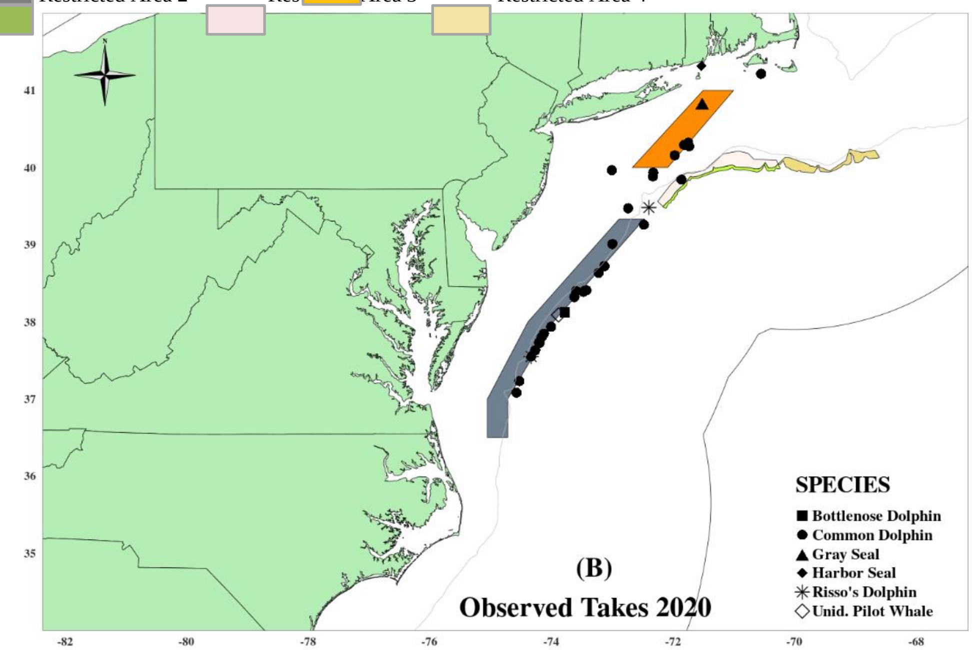


Figure 16. 2016 Northeast bottom trawl observed tows (A) and observed takes (B).

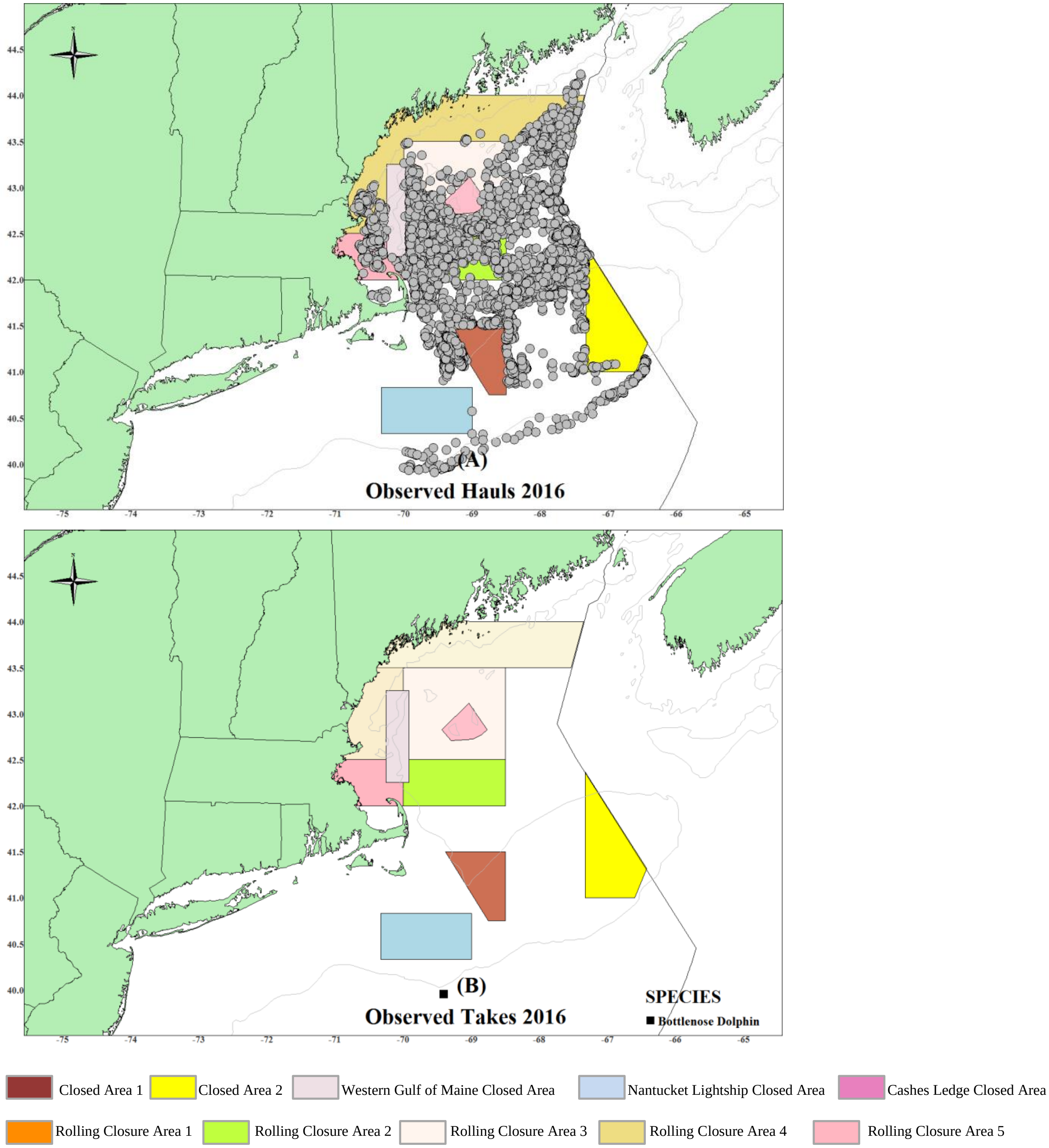


Figure 17. 2017 Northeast bottom trawl observed tows (A) and observed takes (B).

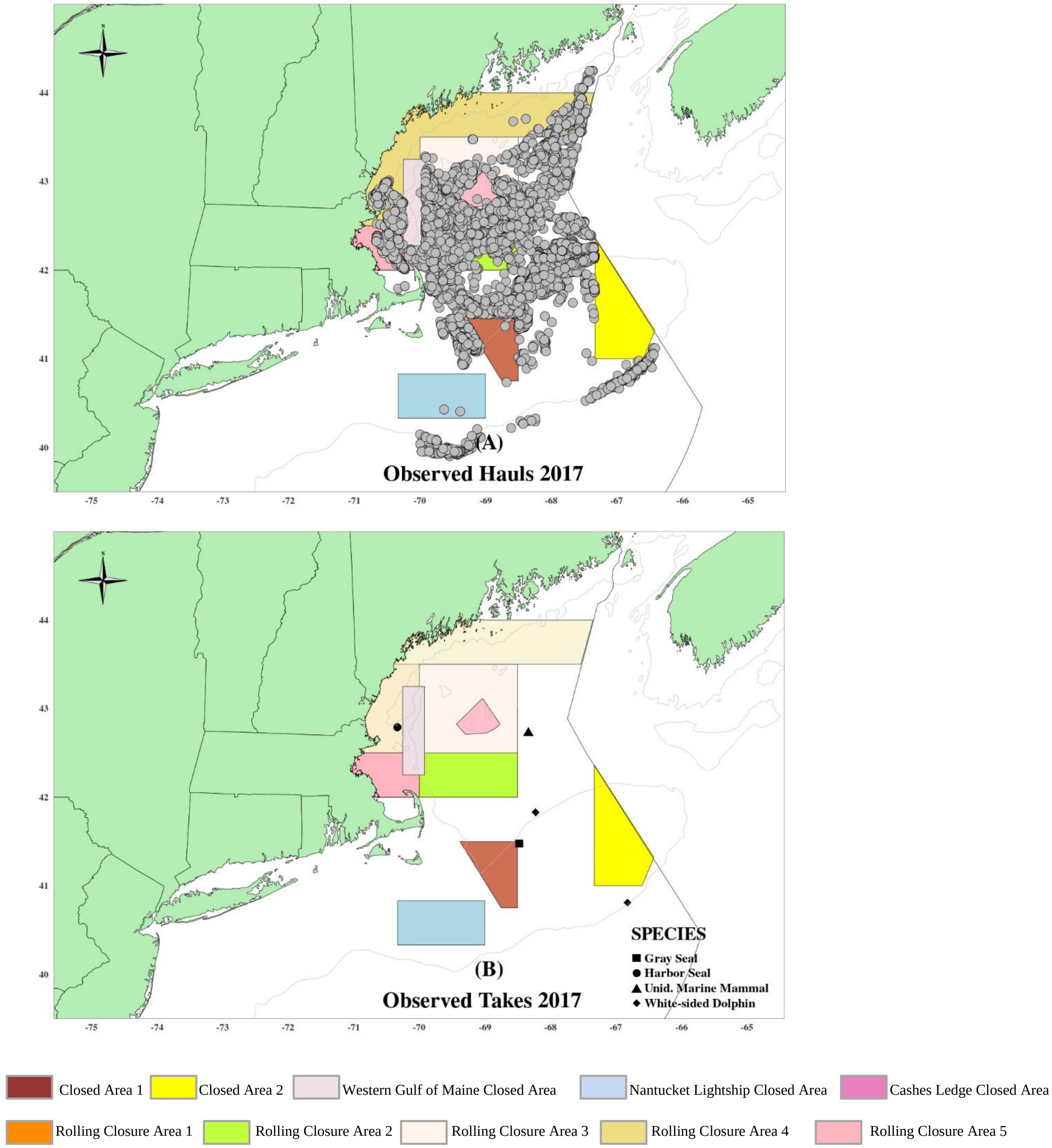


Figure 18. 2018 Northeast bottom trawl observed tows (A) and observed takes (B).

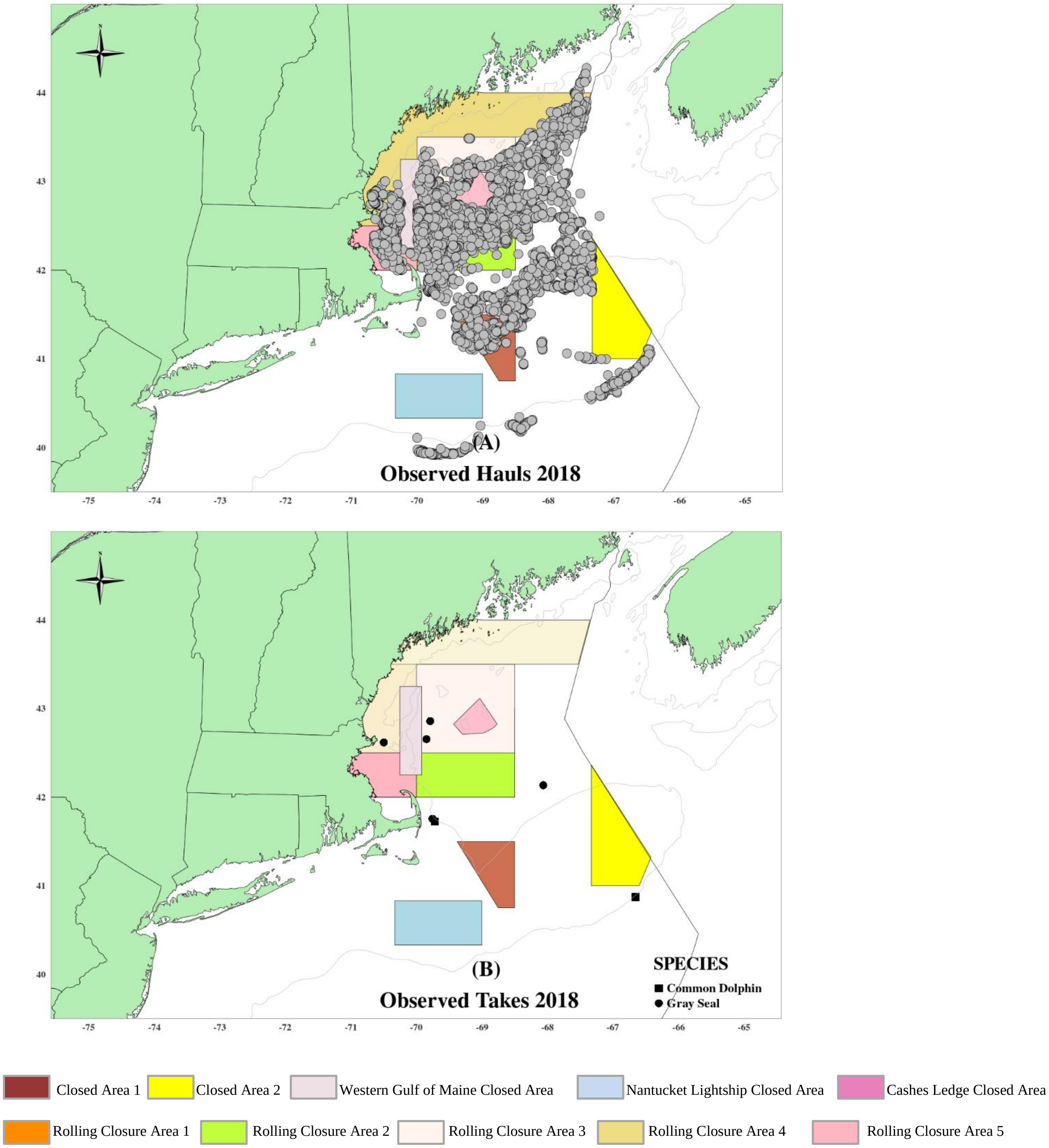


Figure 19. 2019 Northeast bottom trawl observed tows (A) and observed takes (B).

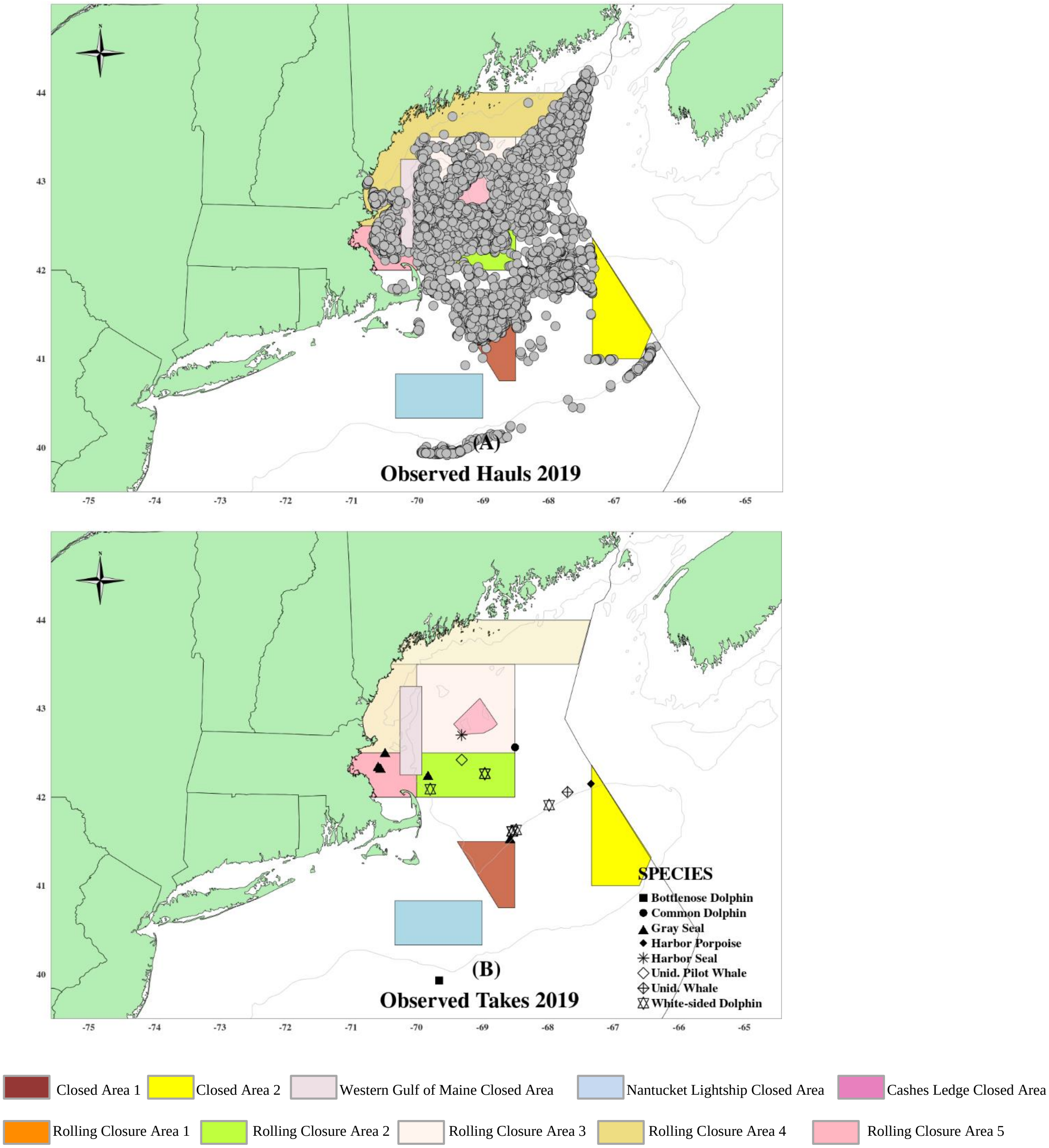


Figure 20. 2020 Northeast bottom trawl observed tows (A) and observed takes (B).

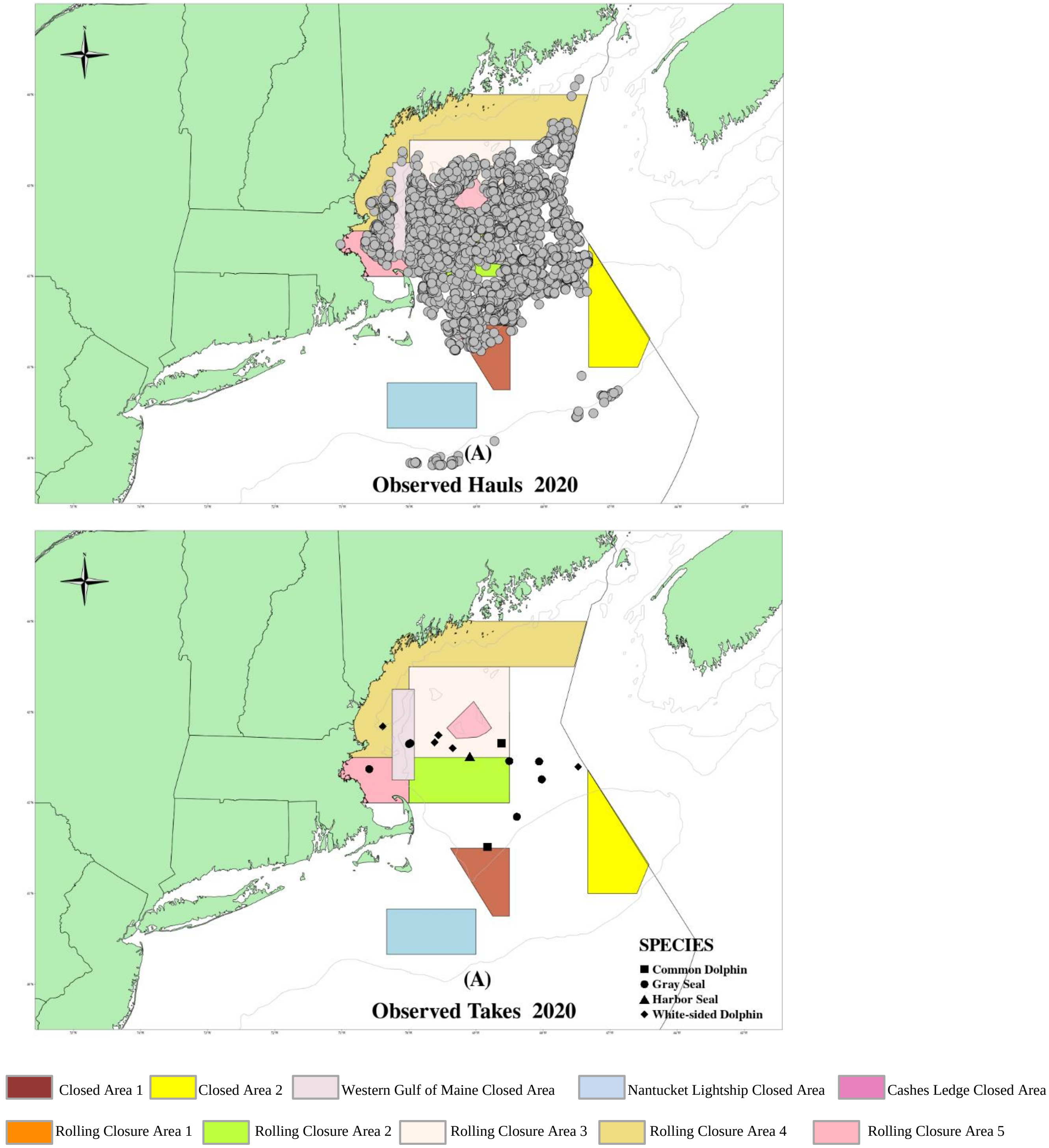


Figure 21. 2016 Northeast mid-water trawl observed tows (A) and observed takes (B).

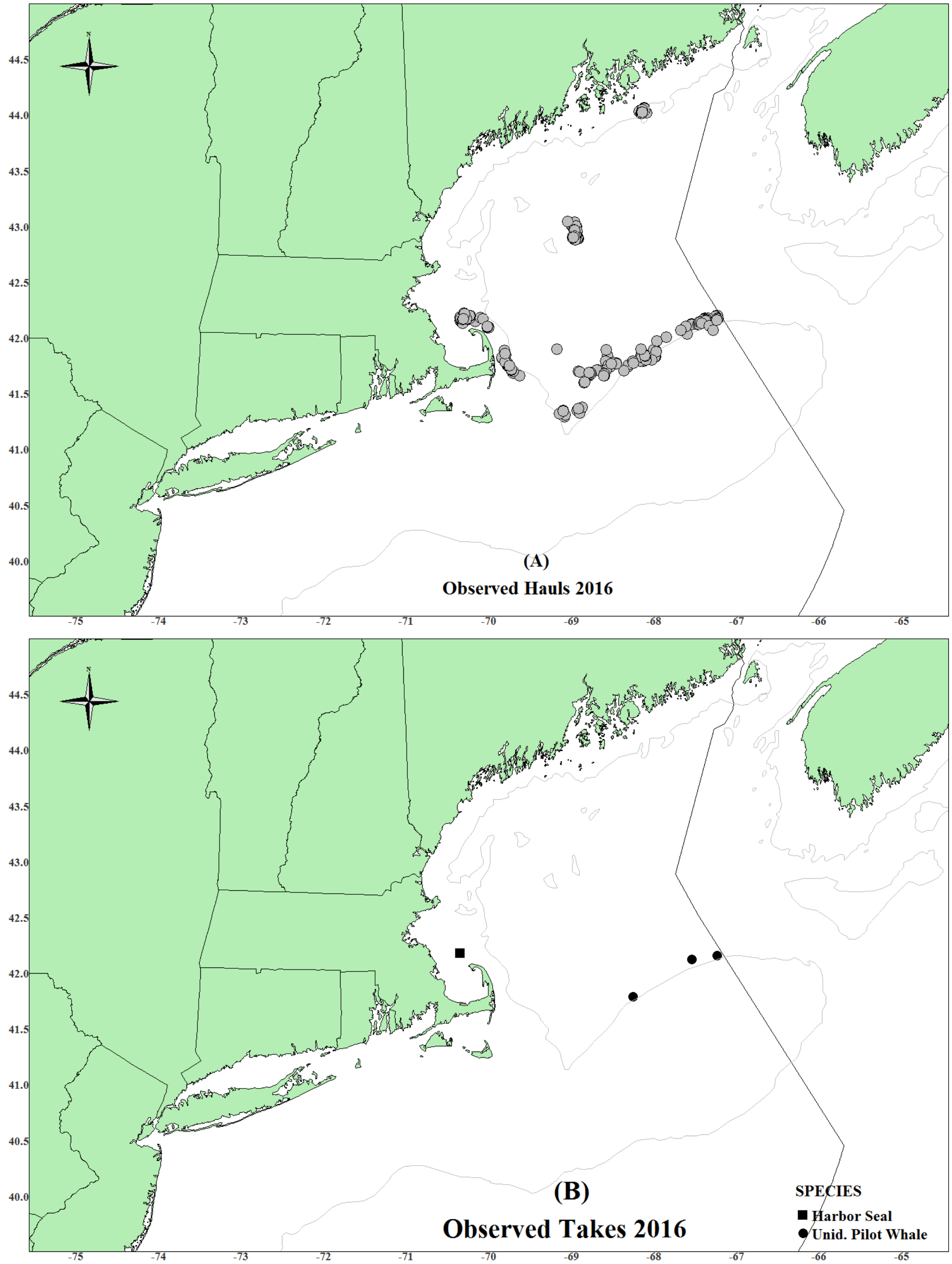


Figure 22. 2017 Northeast mid-water trawl observed tows (A) and observed takes (B).

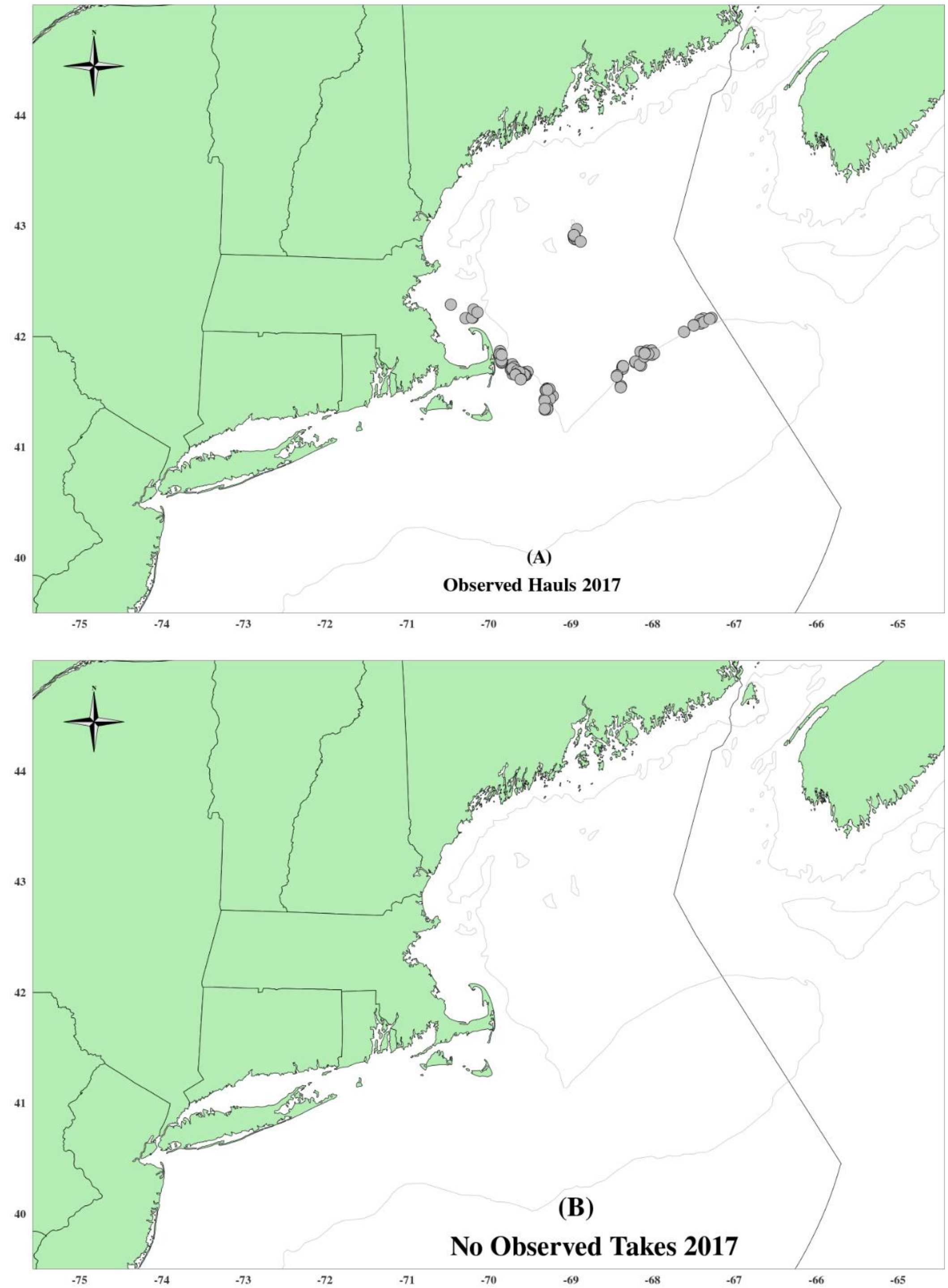
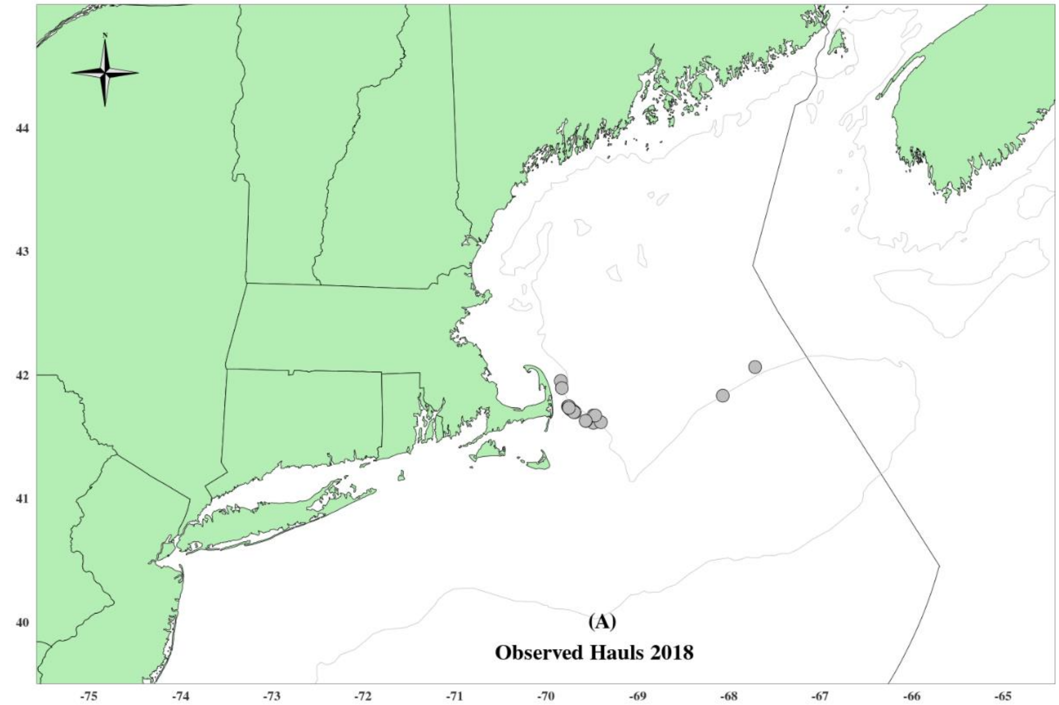


Figure 23. 2018 Northeast mid-water trawl observed tows (A) and observed takes (B).



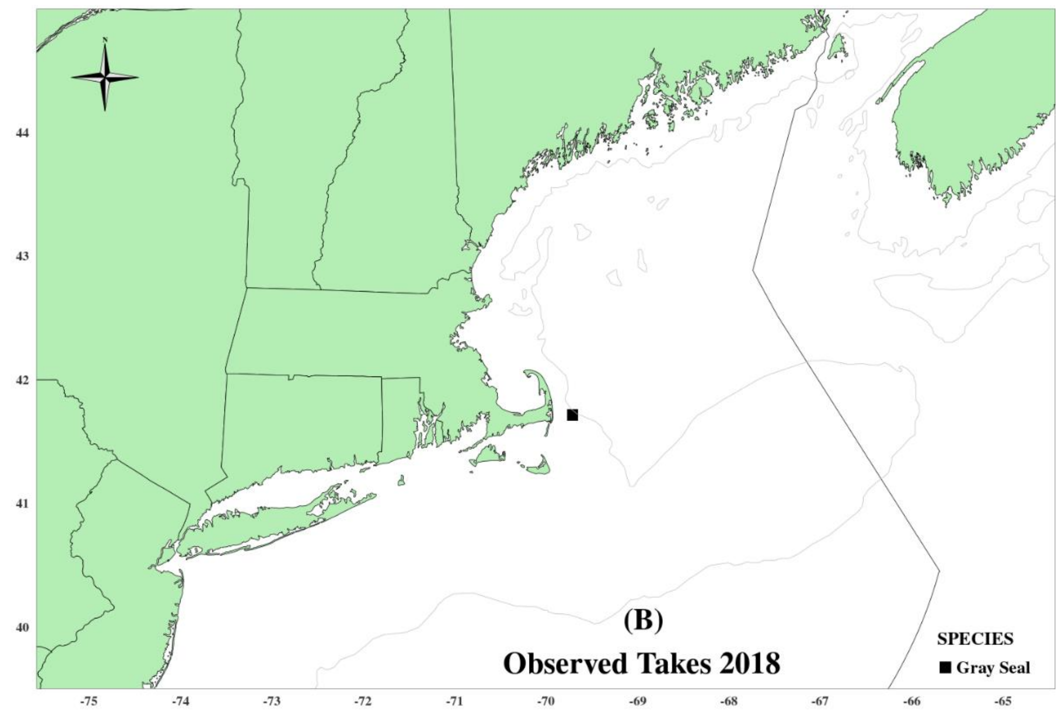


Figure 24. 2019 Northeast mid-water trawl observed tows (A) and observed takes (B).

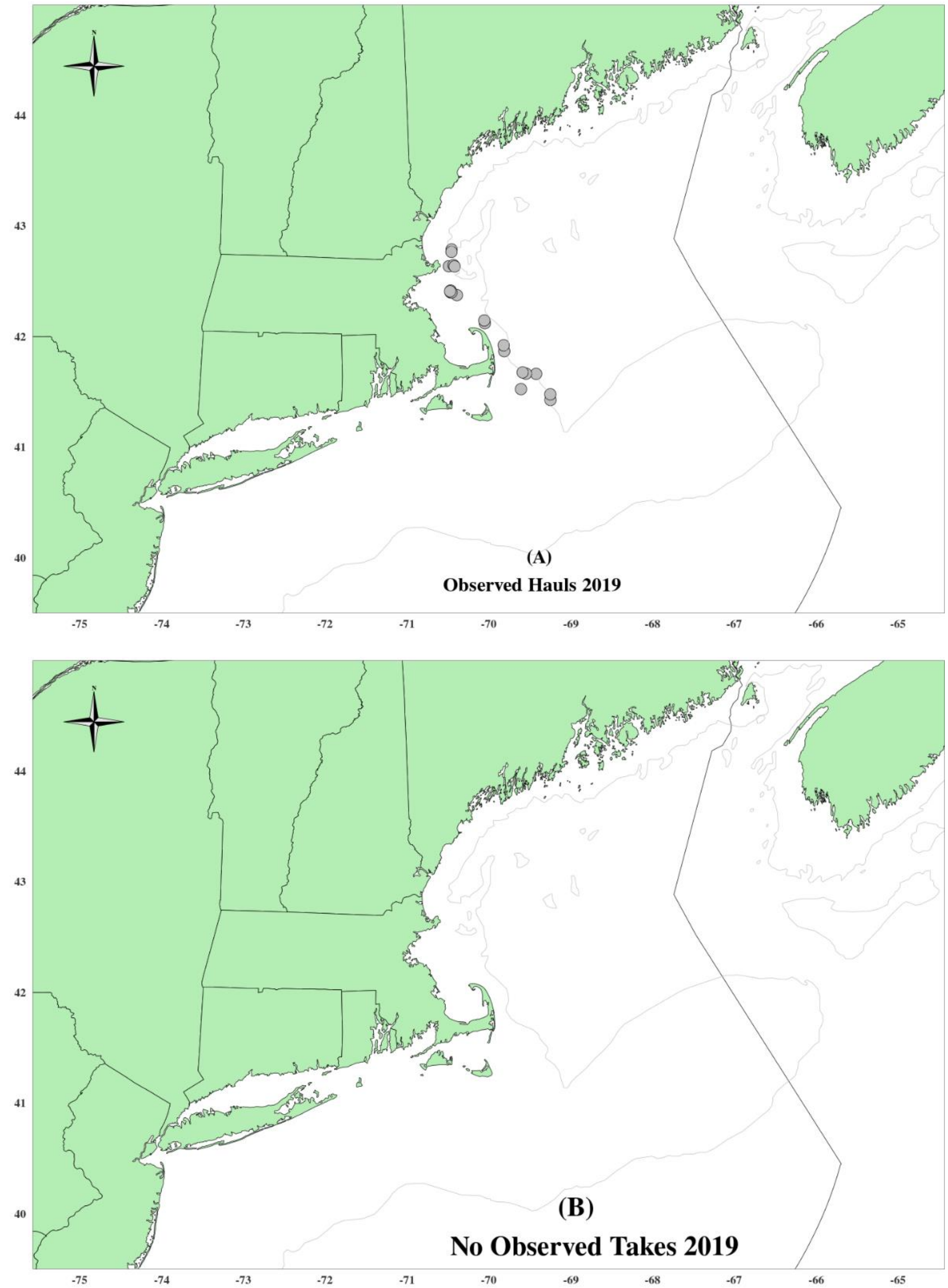
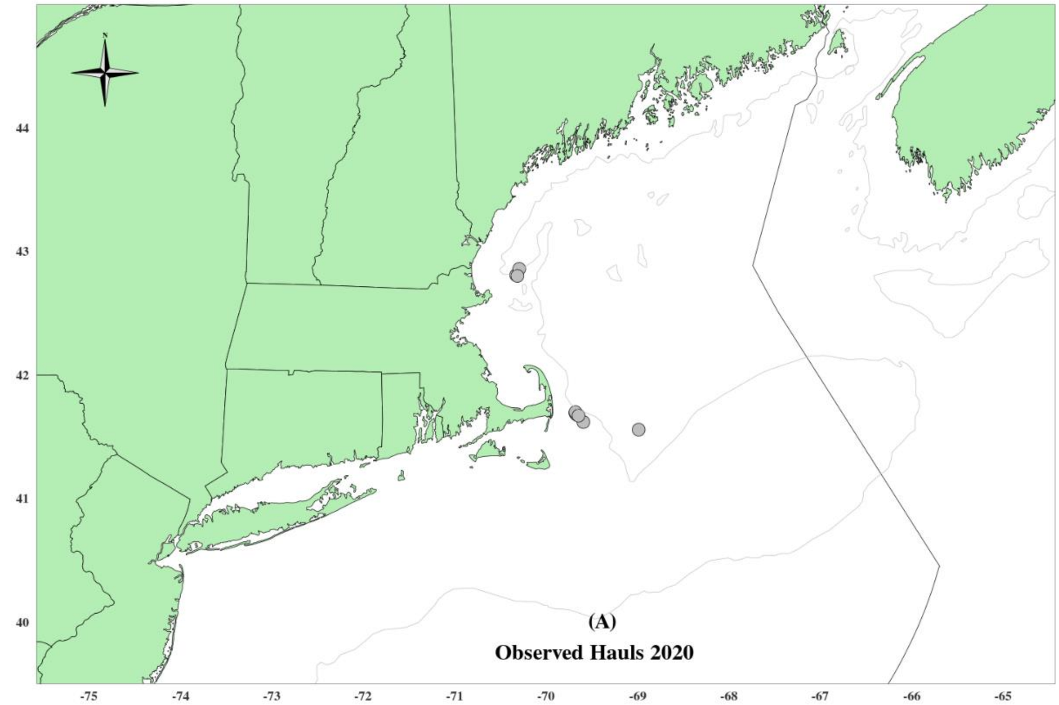


Figure 25. 2020 Northeast mid-water trawl observed tows (A) and observed takes (B).



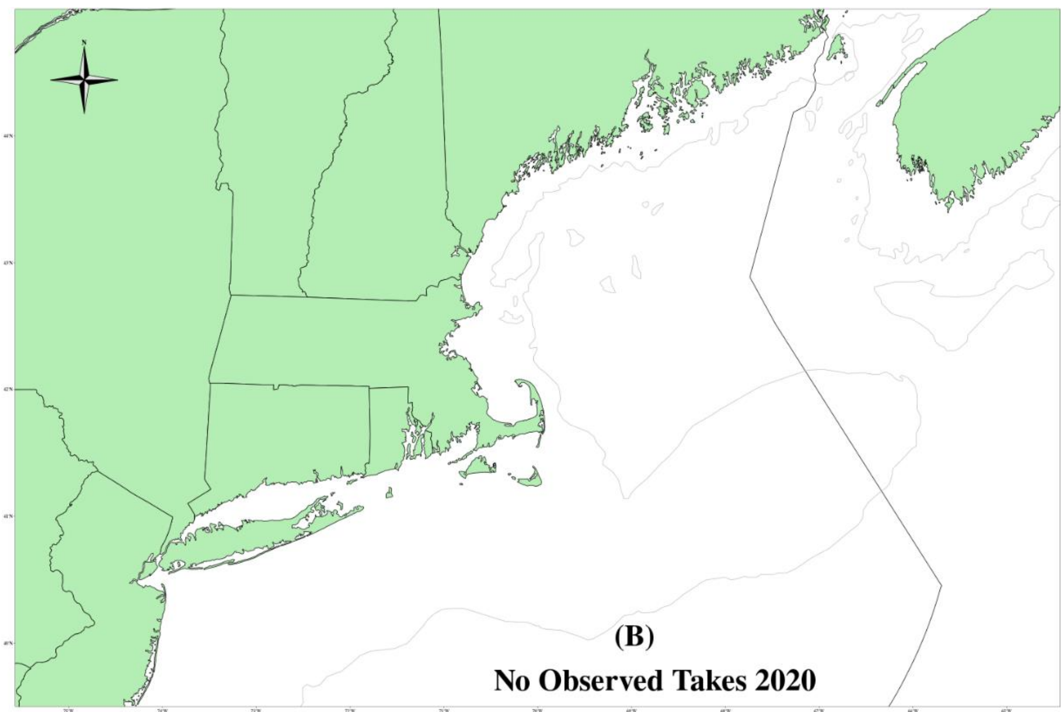


Figure 26. 2016 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

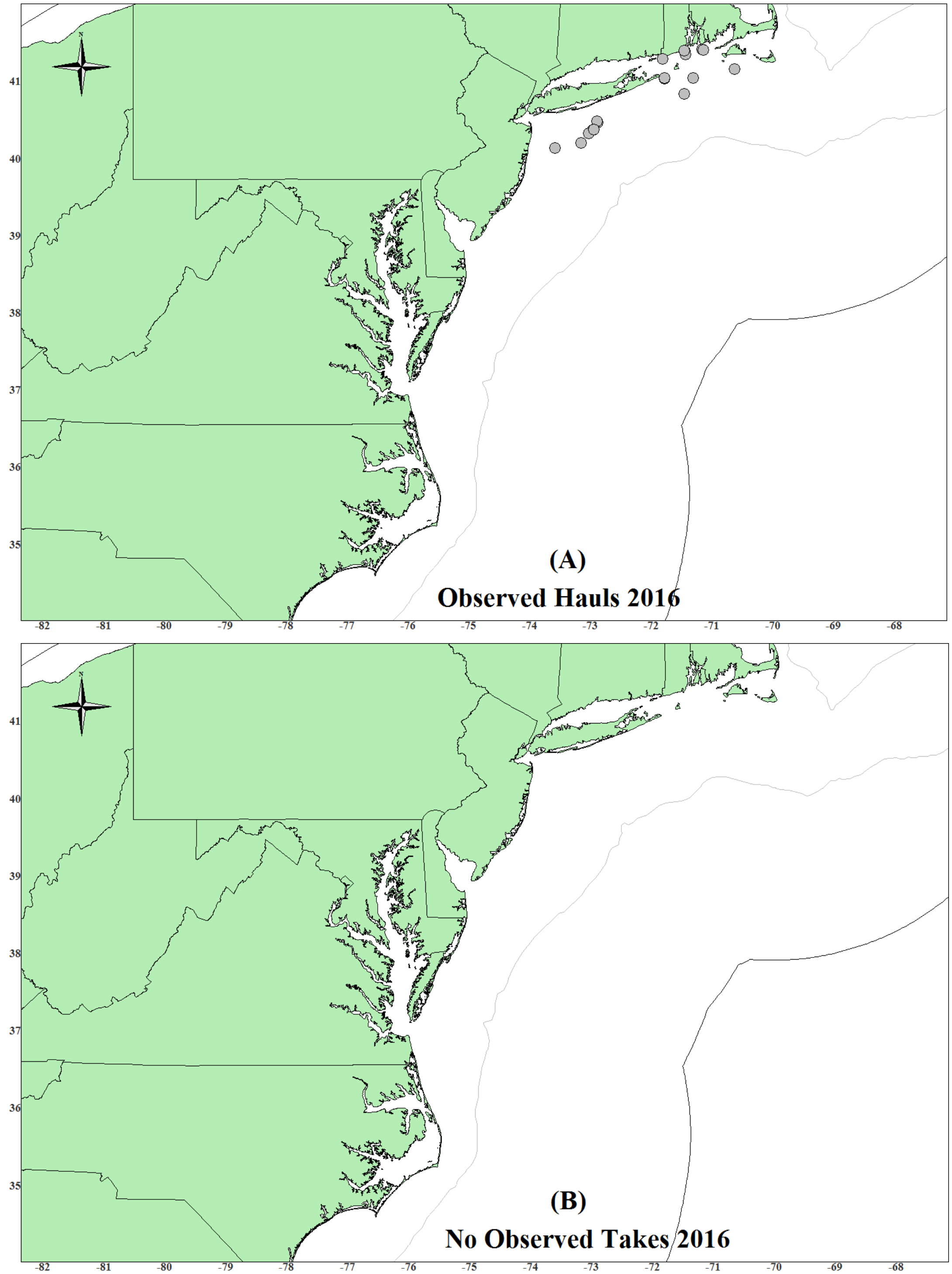


Figure 27. 2017 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).

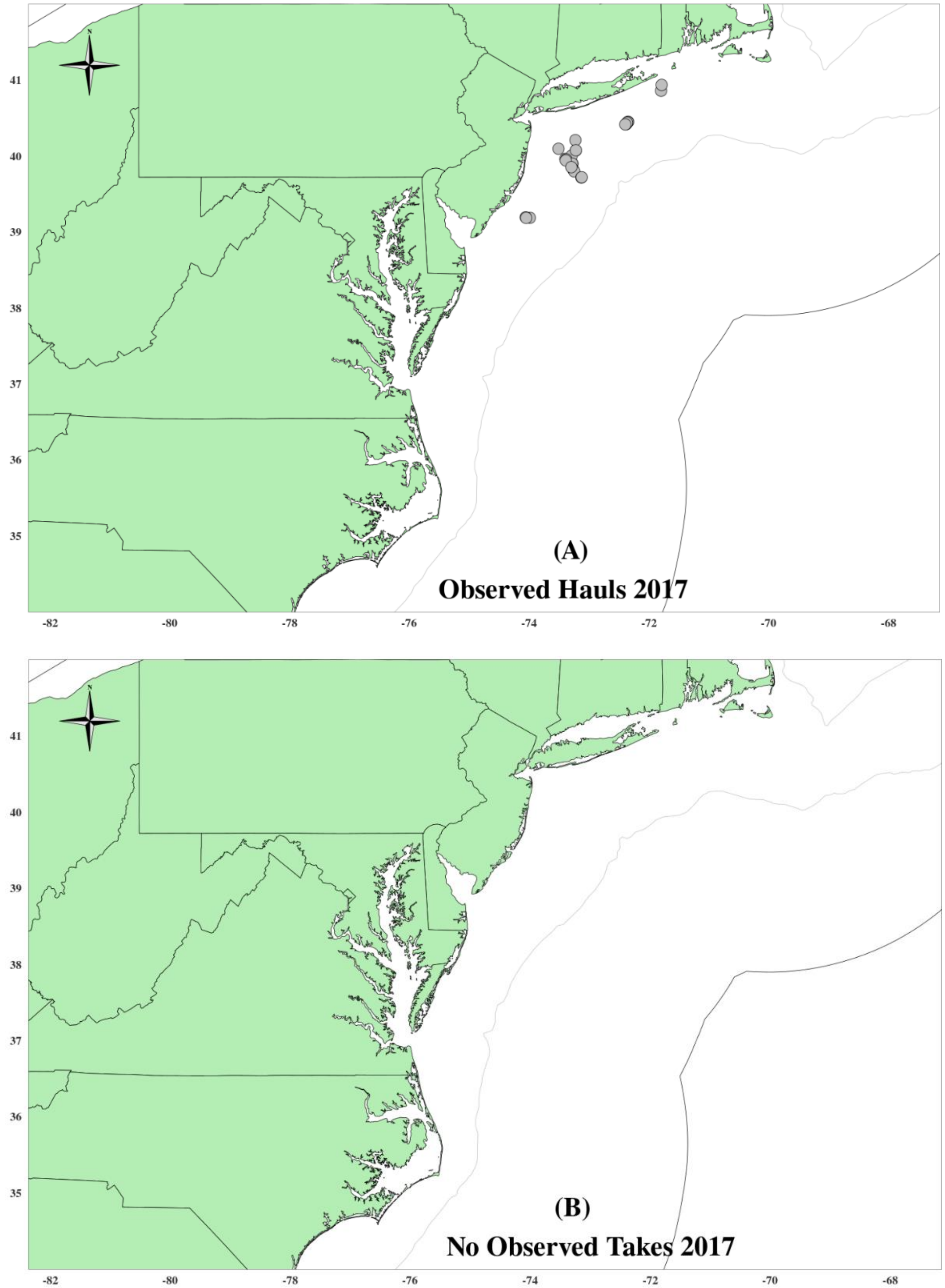
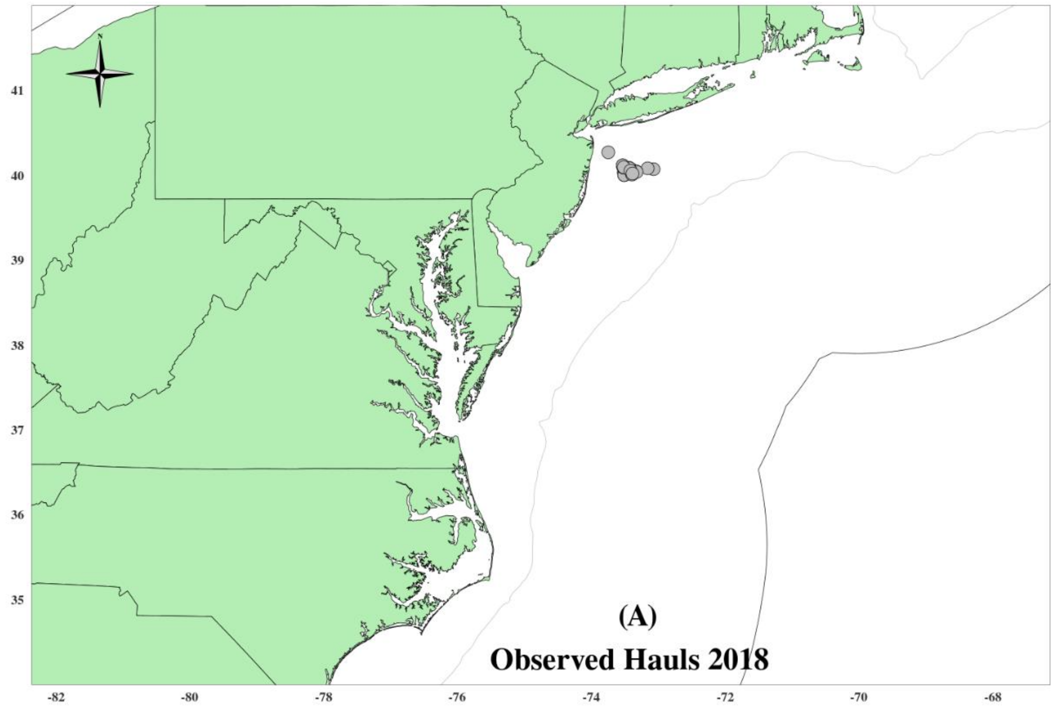


Figure 28. 2018 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).



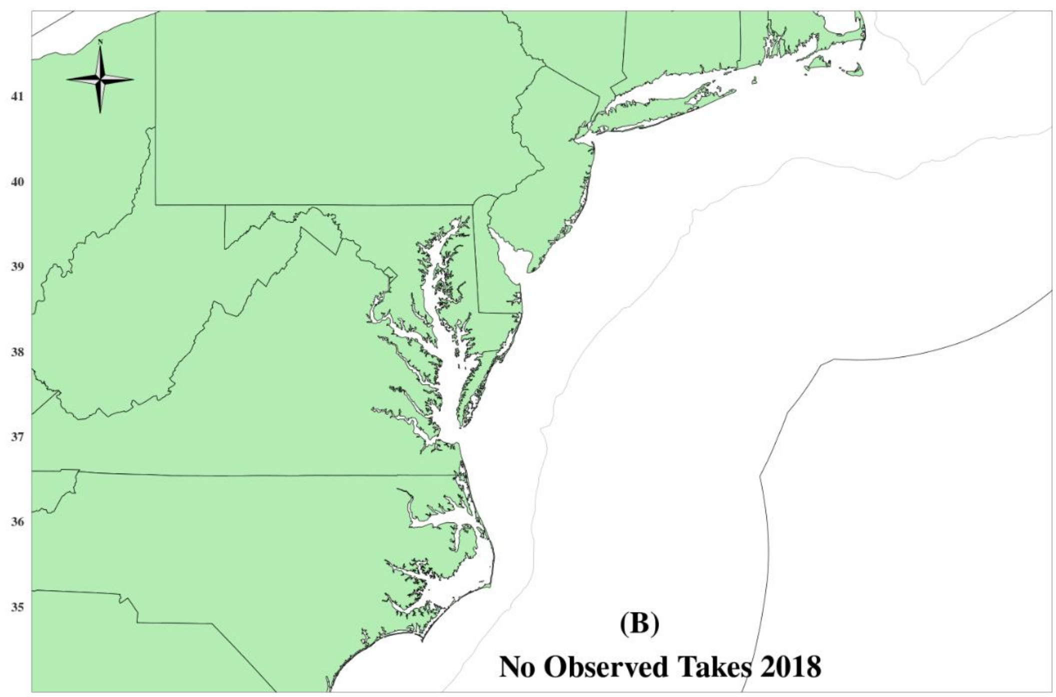
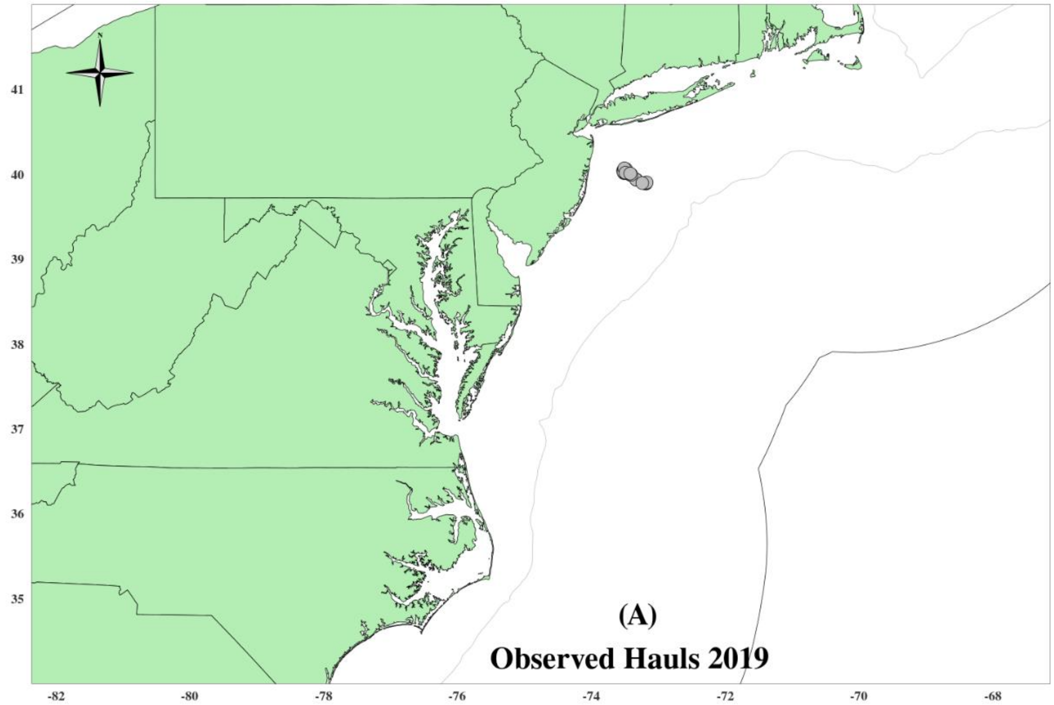


Figure 29. 2019 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).



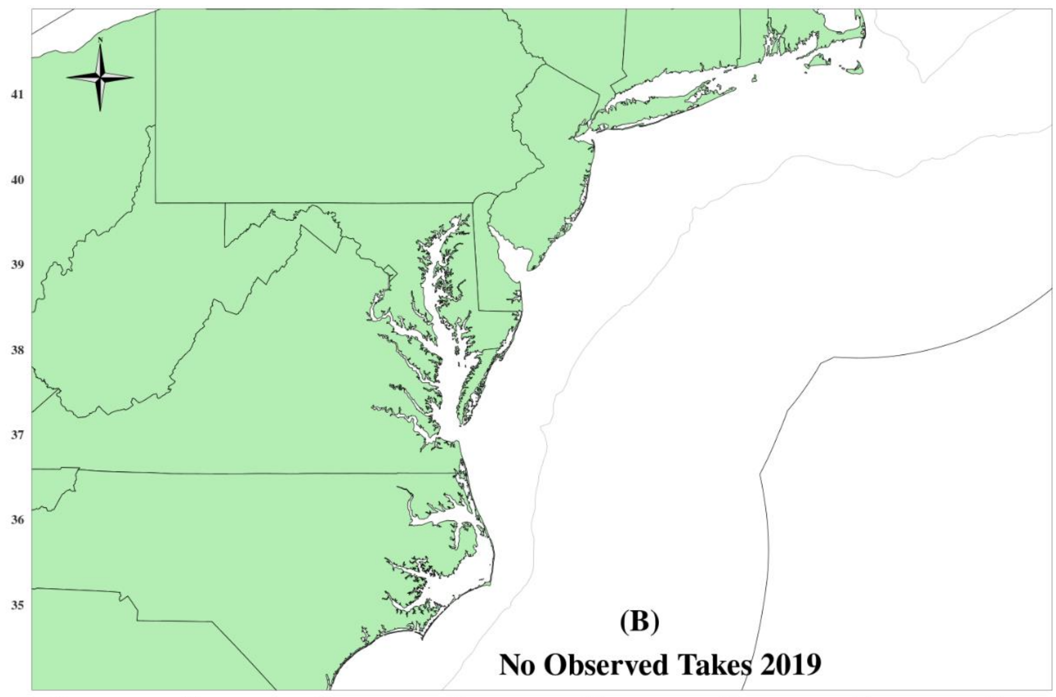
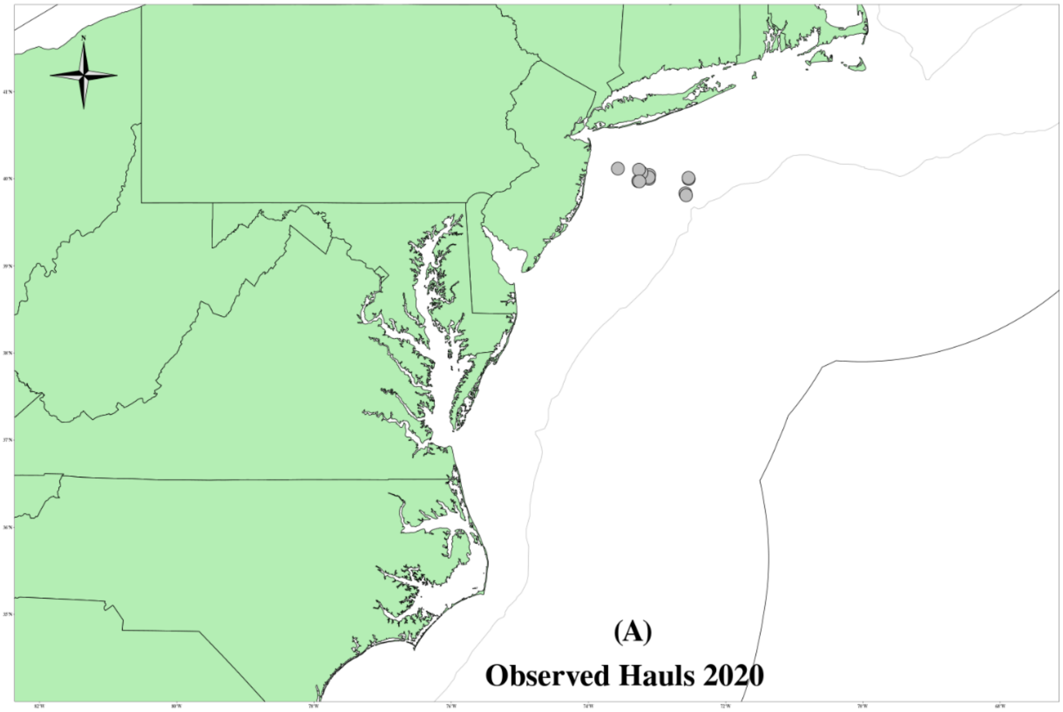


Figure 30. 2020 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).



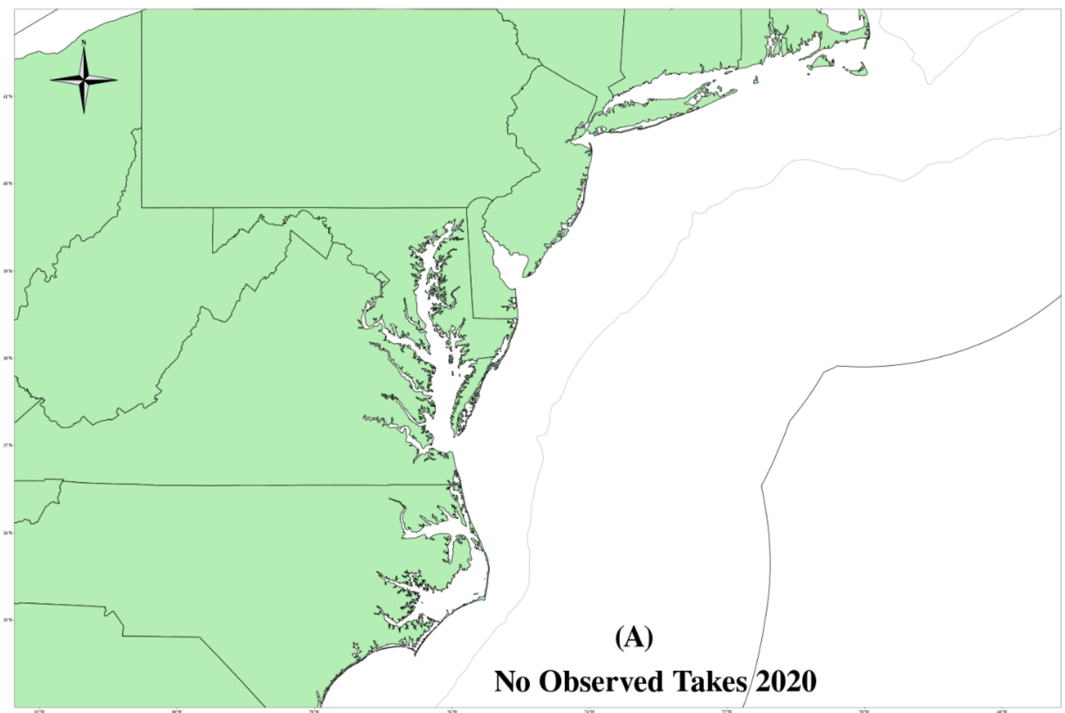
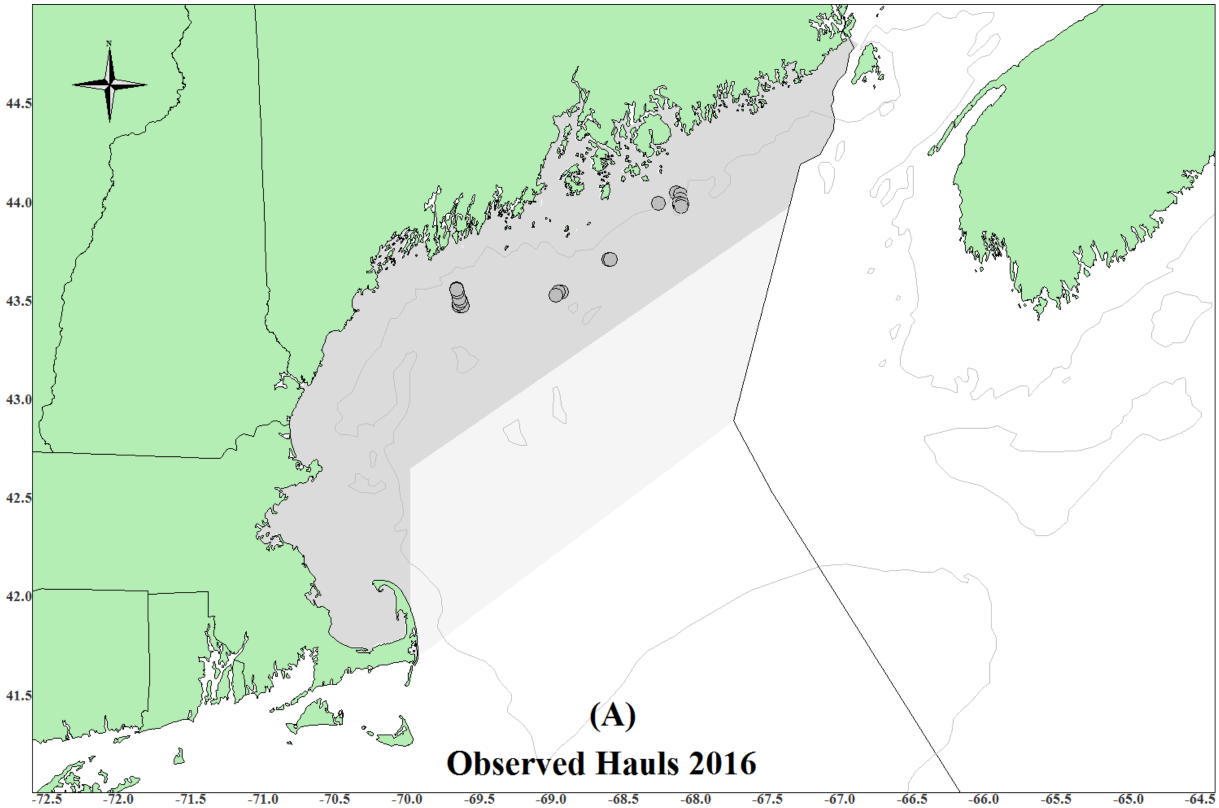


Figure 31. 2016 Herring Purse Seine observed hauls (A) and observed takes (B).



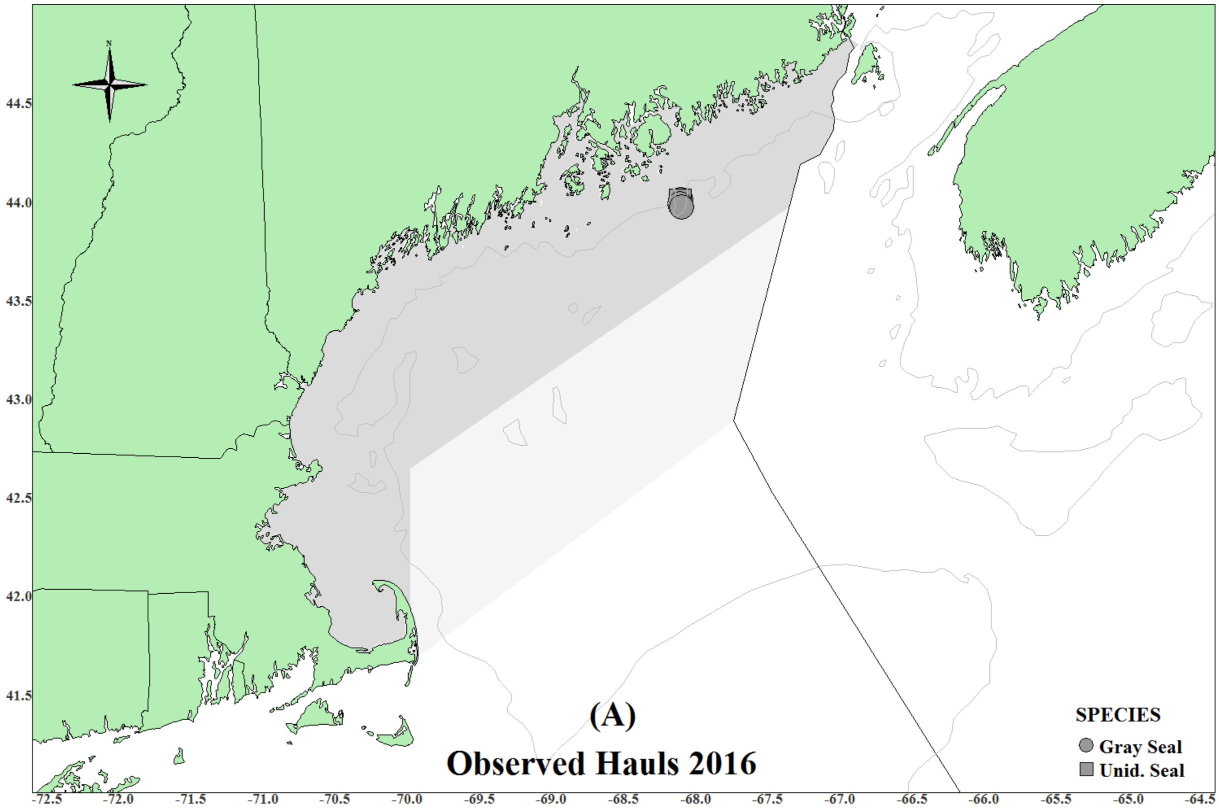
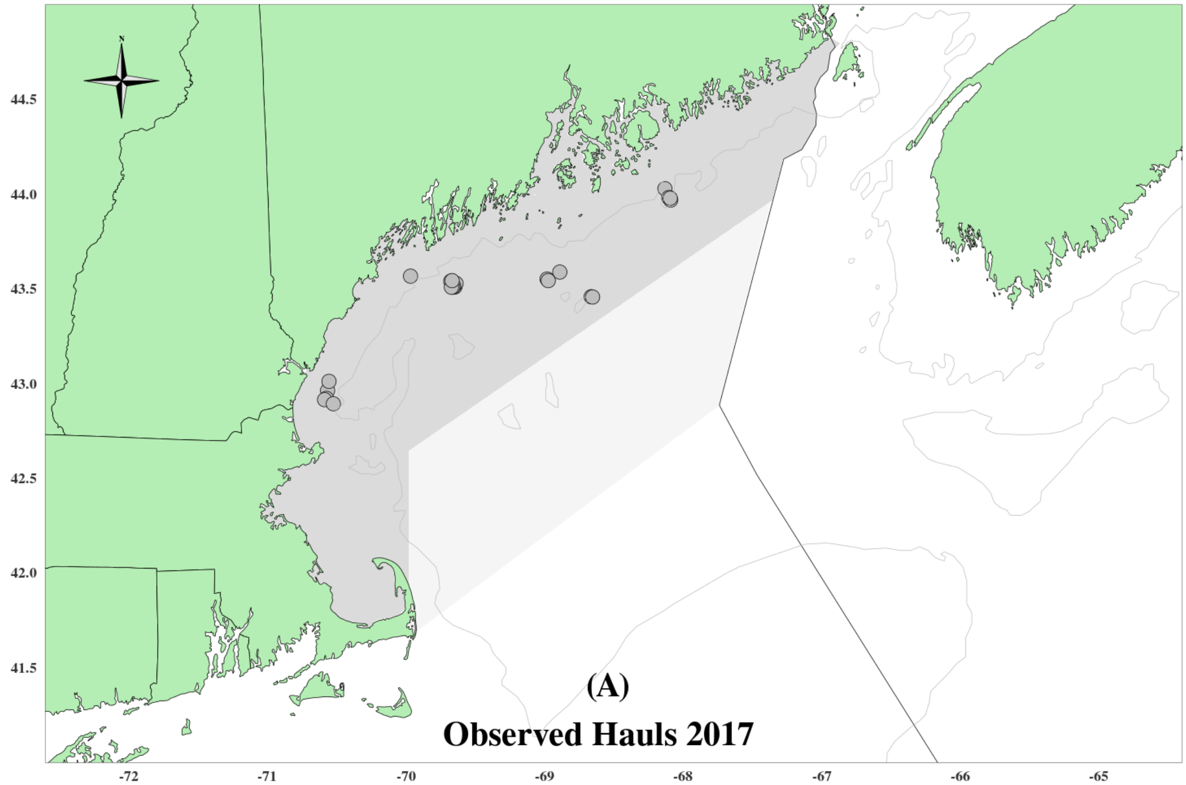


Figure 32. 2017 Herring Purse Seine observed hauls (A) and observed takes (B).



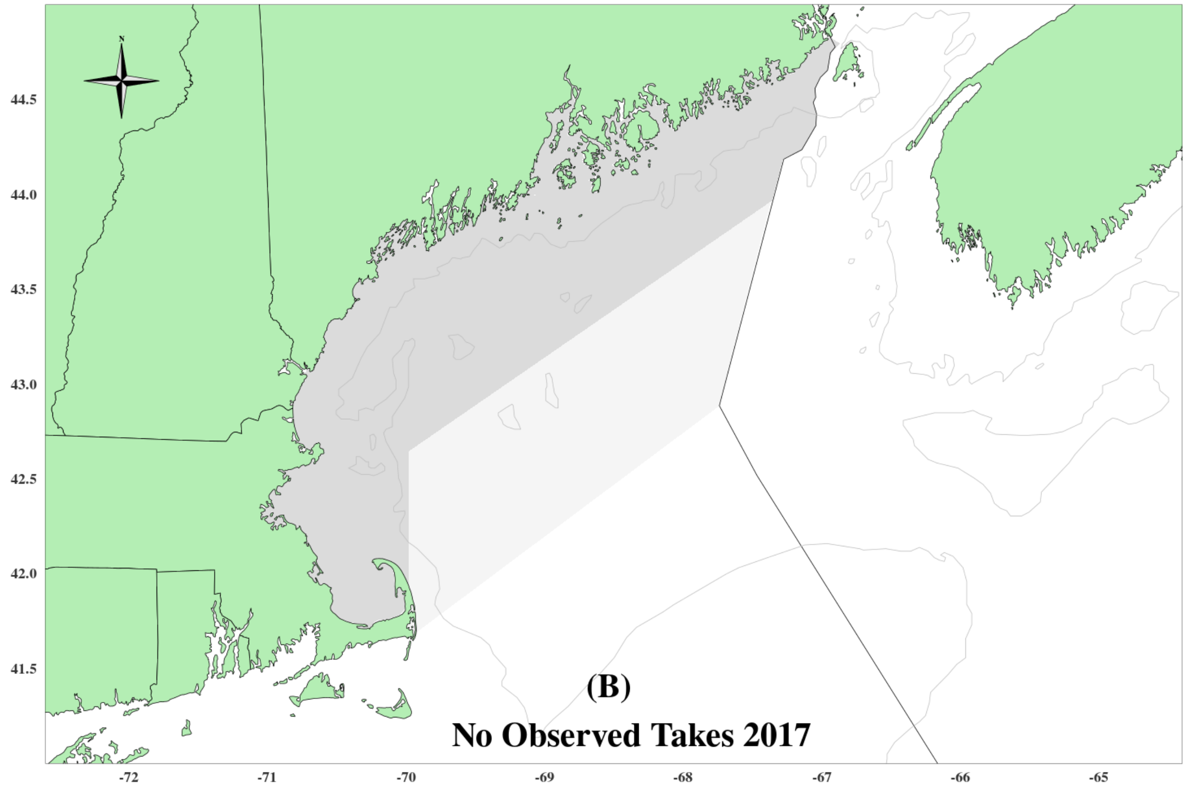


Figure 33. 2018 Herring Purse Seine observed hauls (A) and observed takes (B).

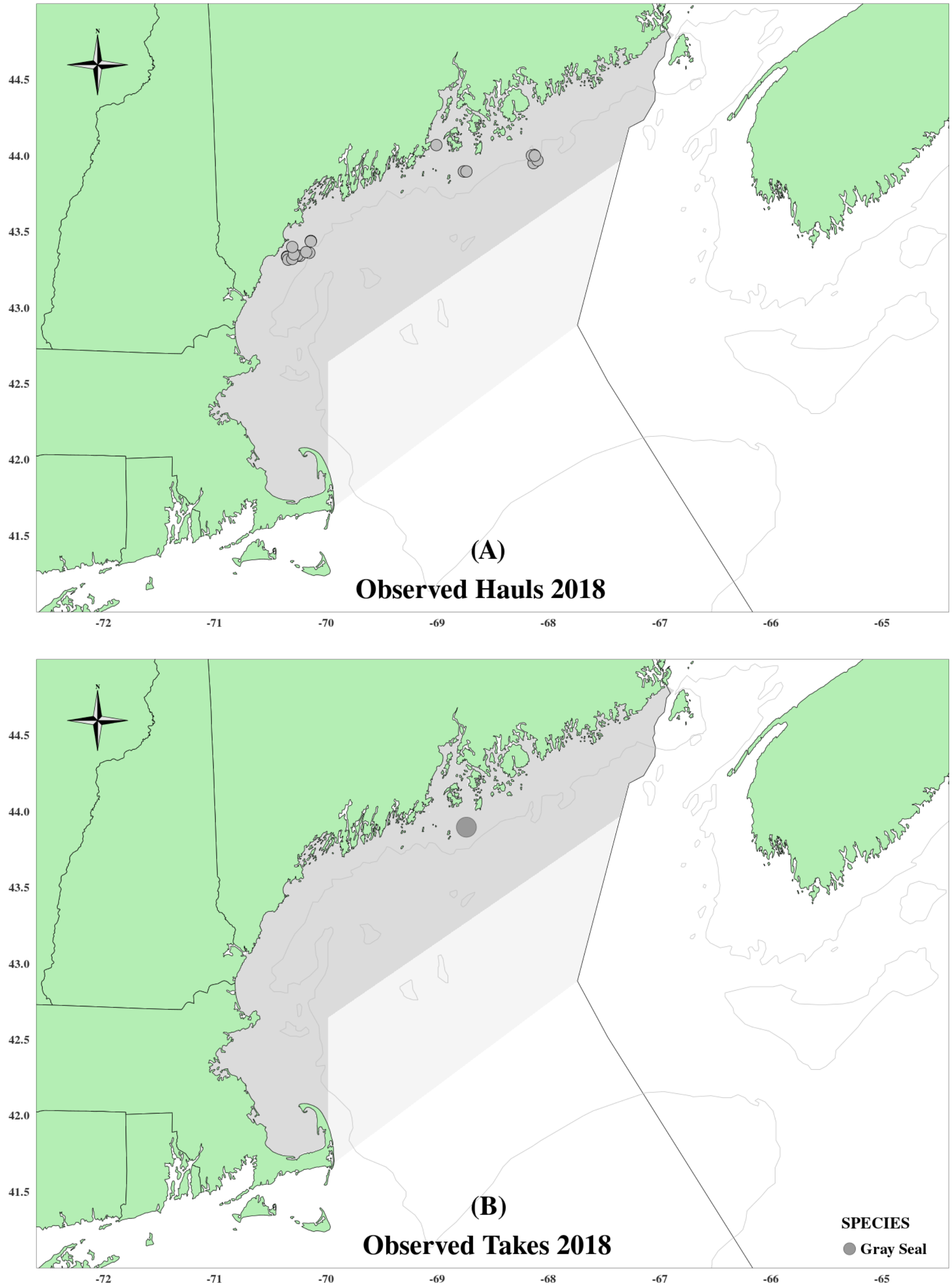
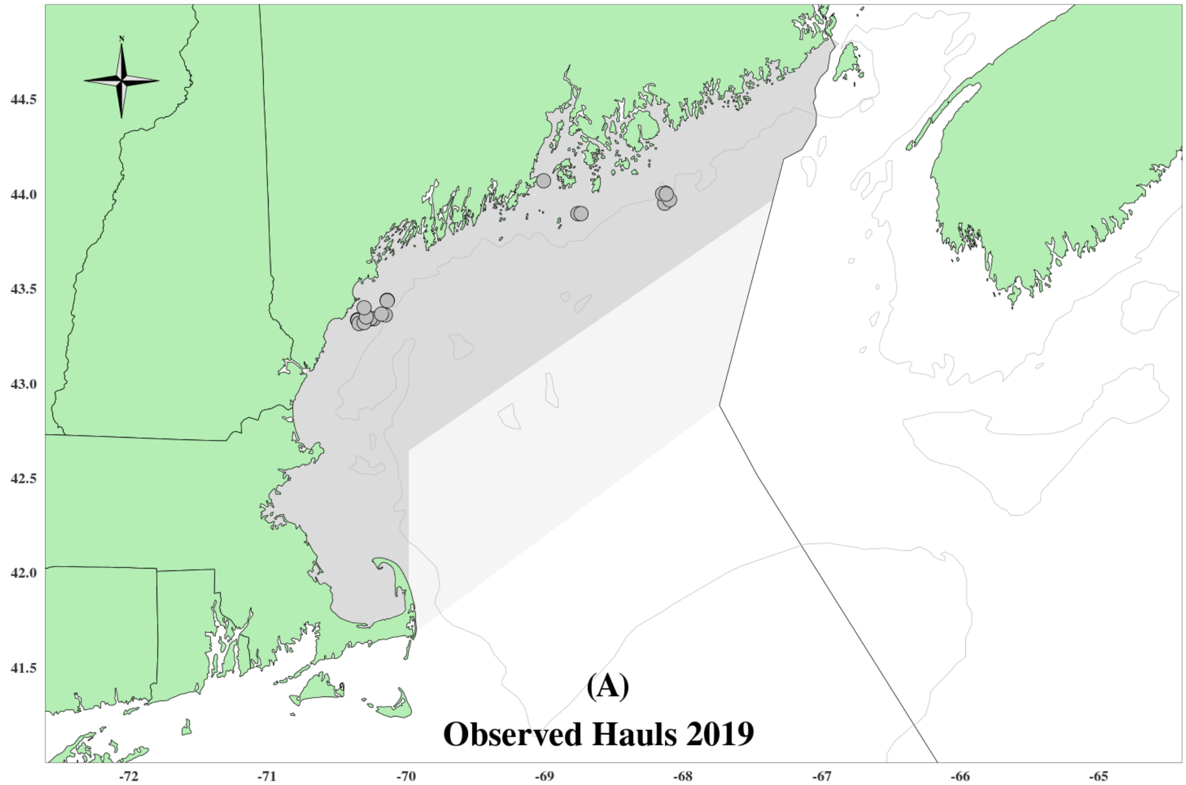


Figure 34. 2019 Herring Purse Seine observed hauls (A) and observed takes (B).



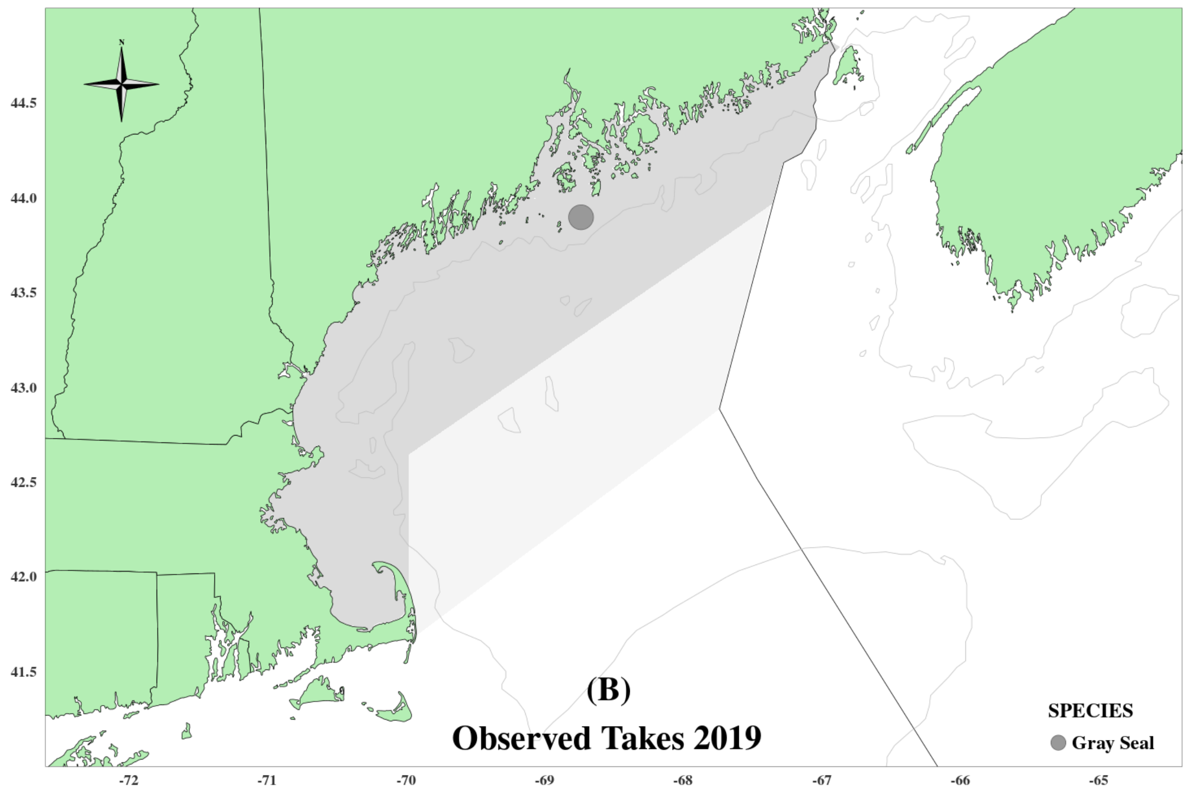
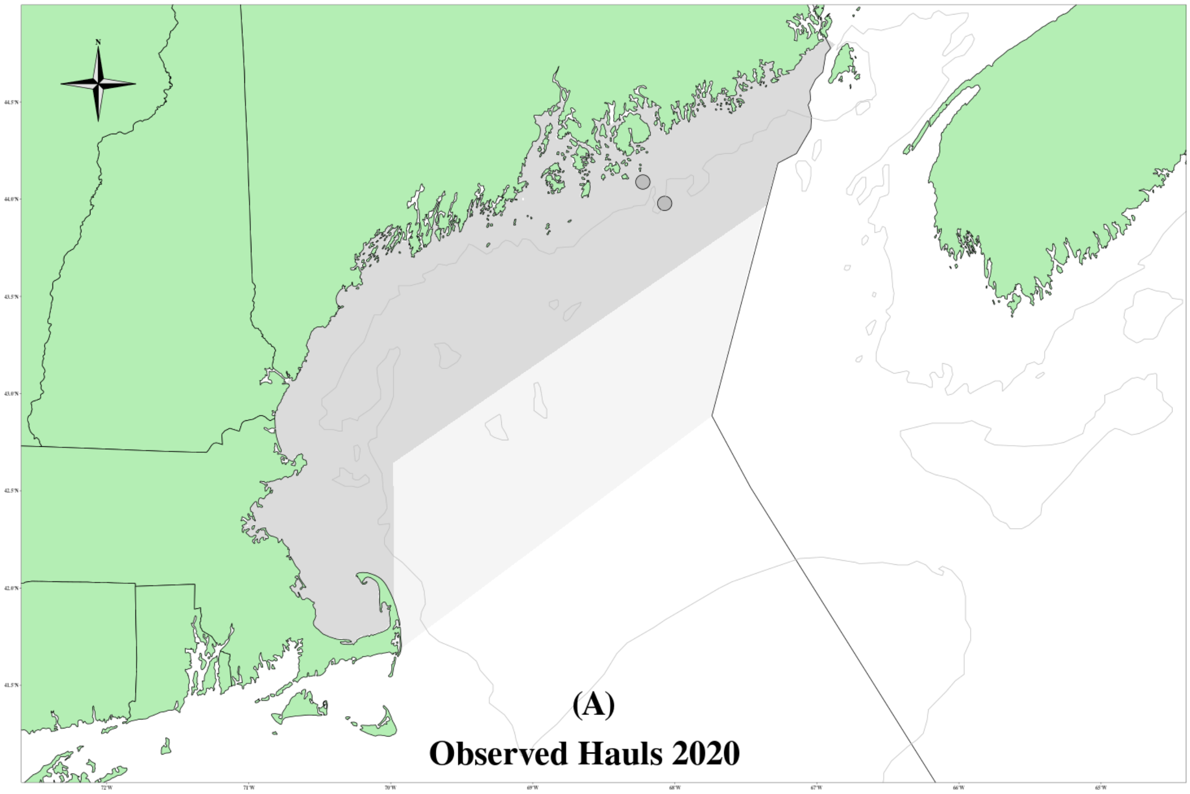


Figure 35. 2020 Herring Purse Seine observed hauls (A) and observed takes (B).



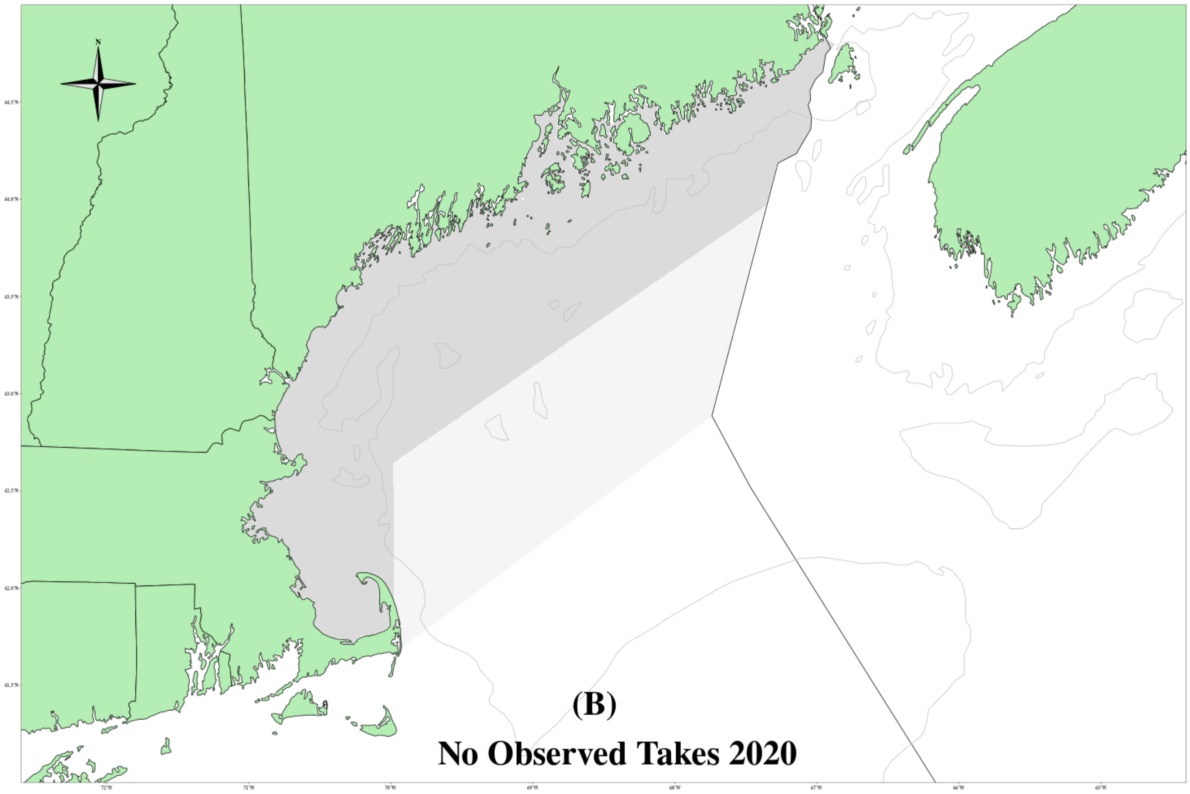


Figure 36. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2016. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

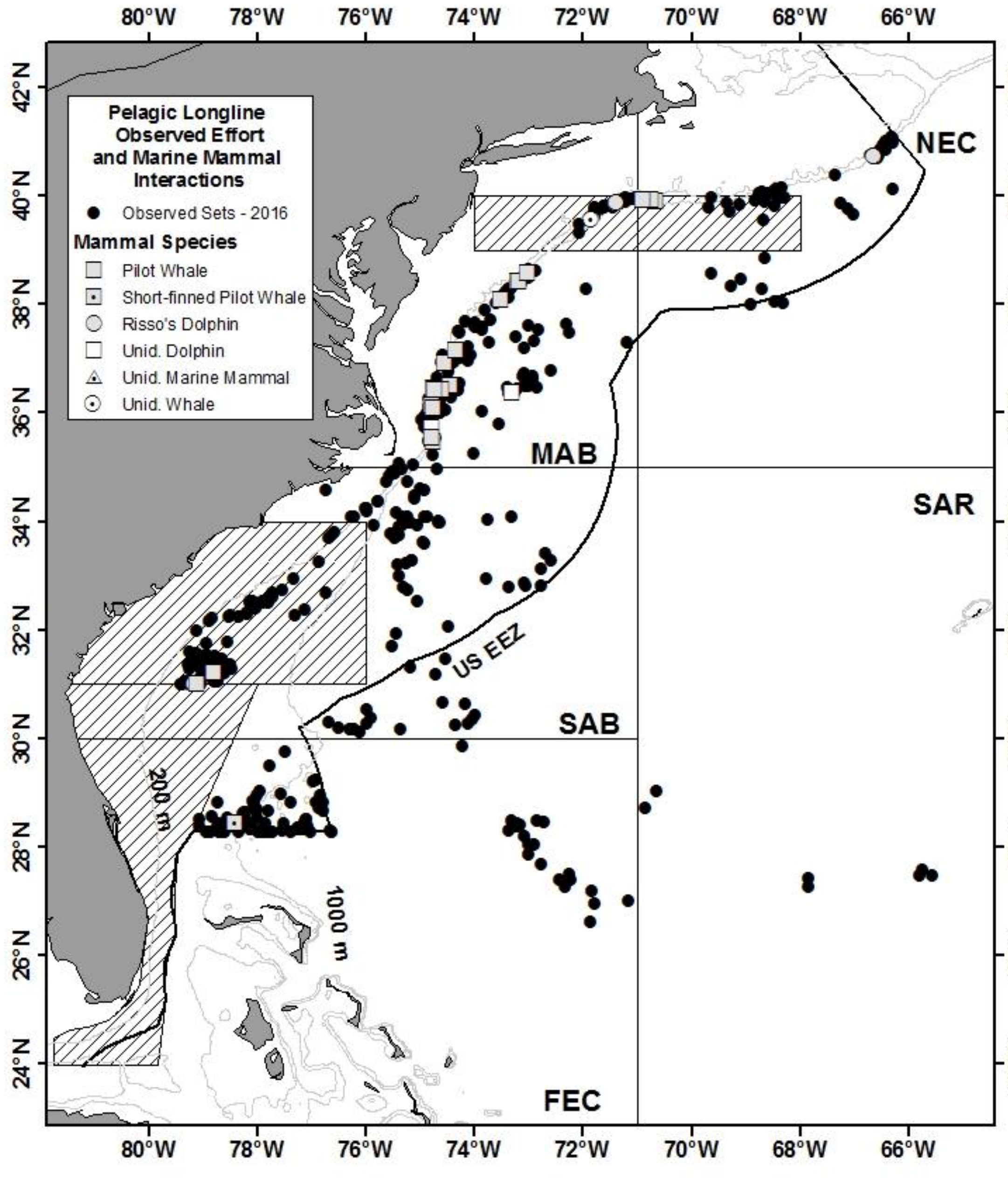


Figure 37. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2017. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

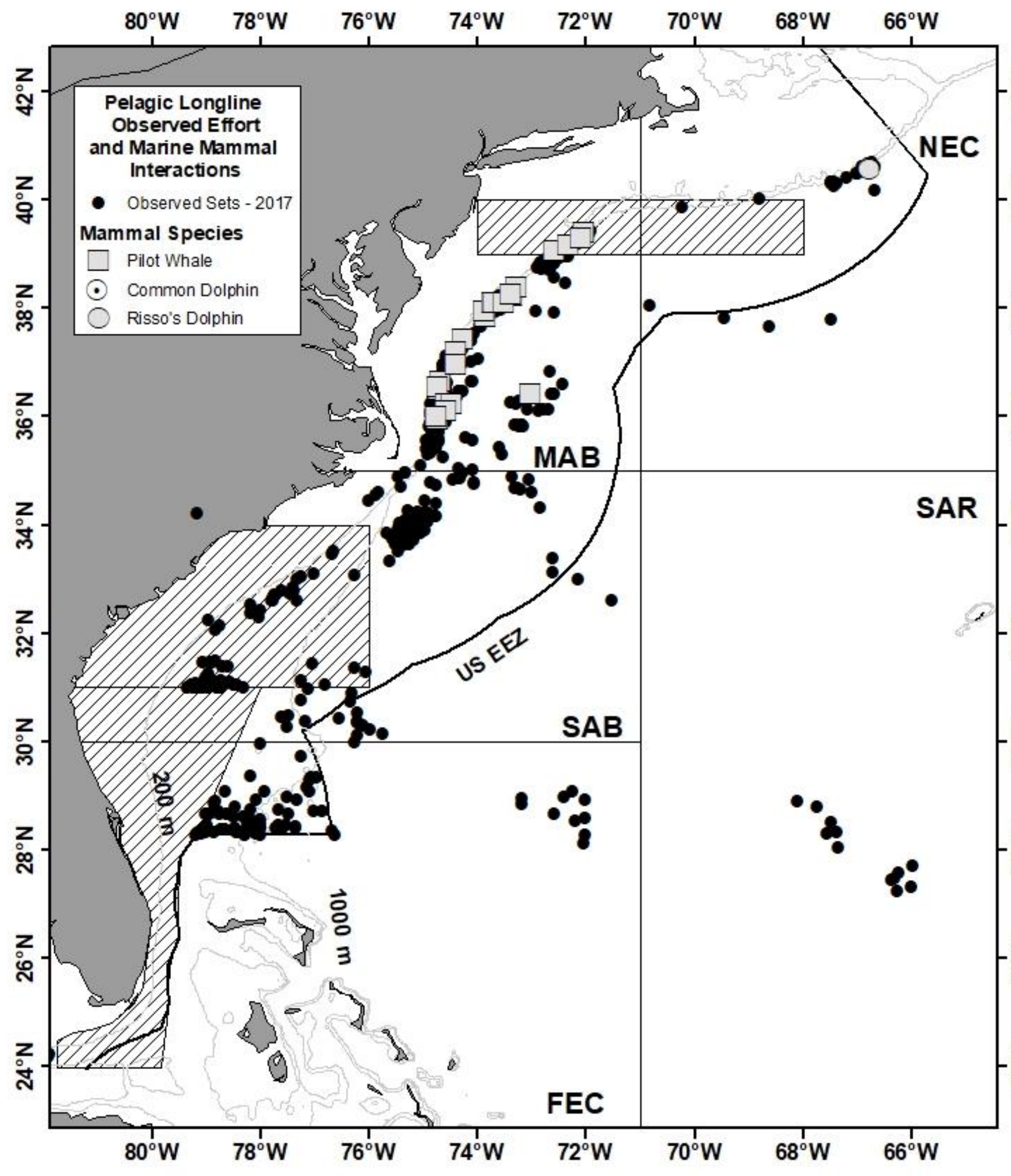


Figure 38. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2018. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

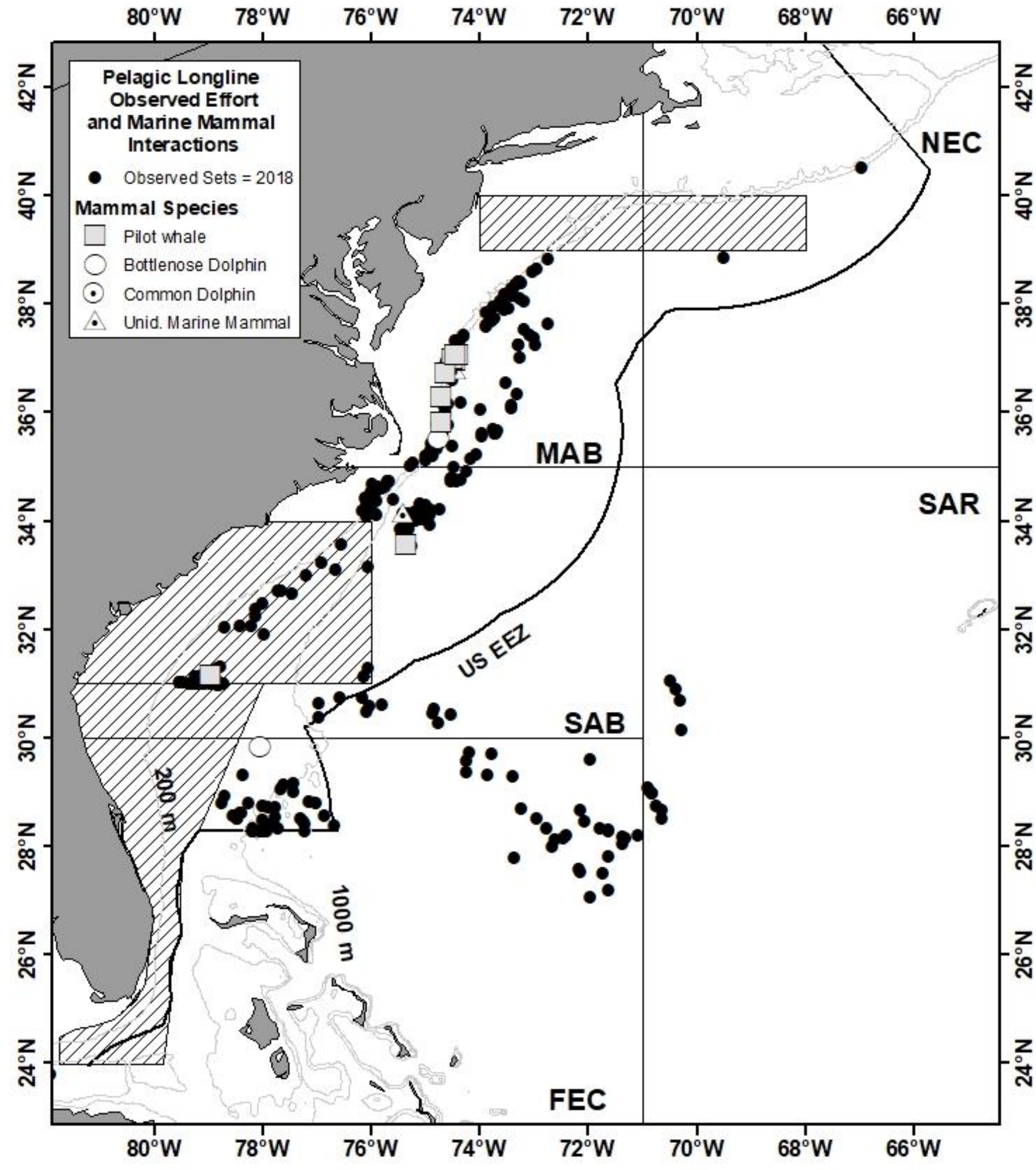


Figure 39. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2019. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

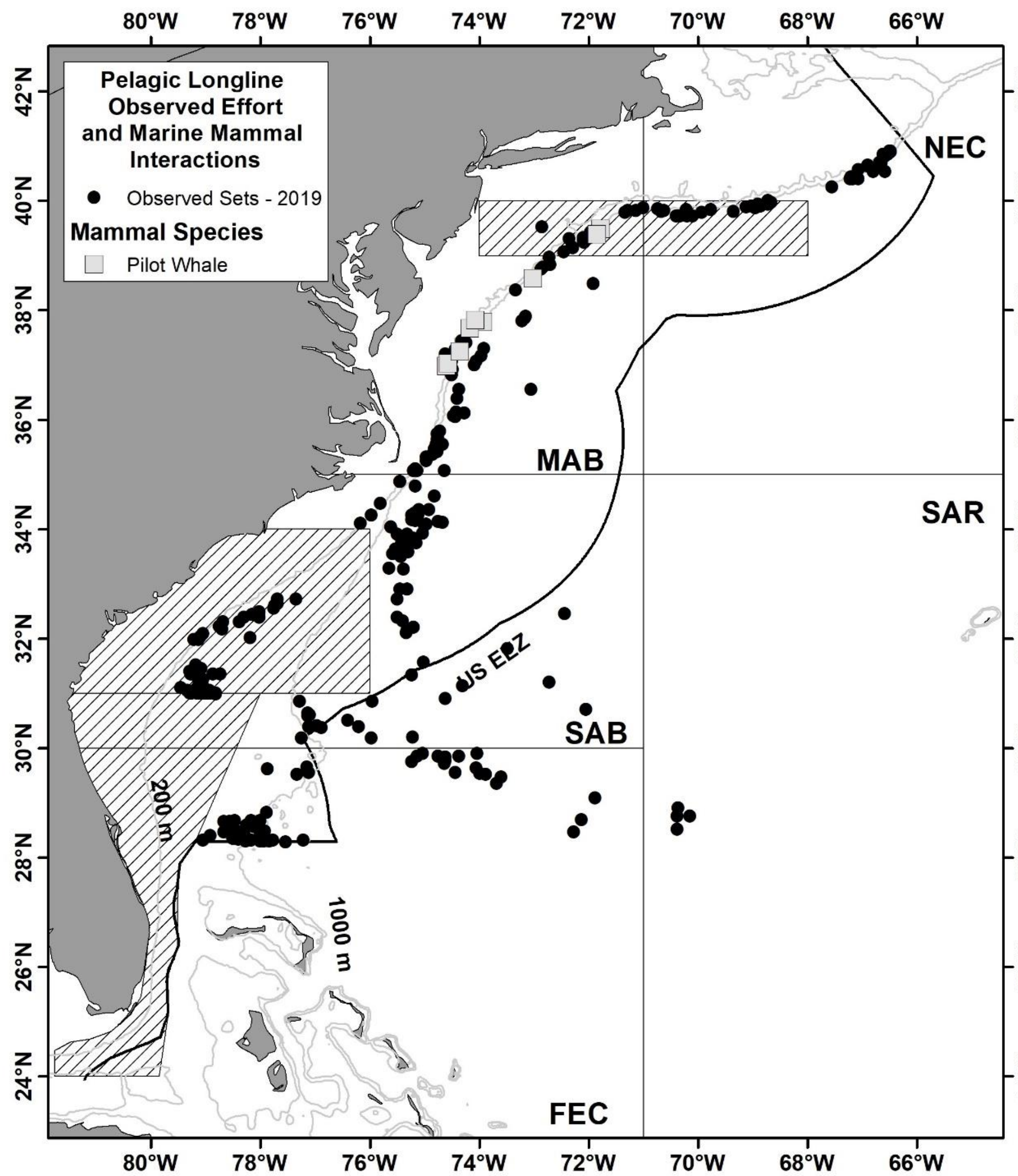


Figure 40. Observed sets and marine mammal interactions in the Pelagic longline fishery along the U.S. Atlantic coast during 2020. The boundaries of the Florida East Coast (FEC), South Atlantic Bight (SAB), Mid-Atlantic Bight (MAB), Northeast Coastal (NEC), and Sargasso Sea (SAR) fishing areas are shown. Seasonal closed areas instituted in 2001 under the HMS FMP are shown as hatched areas.

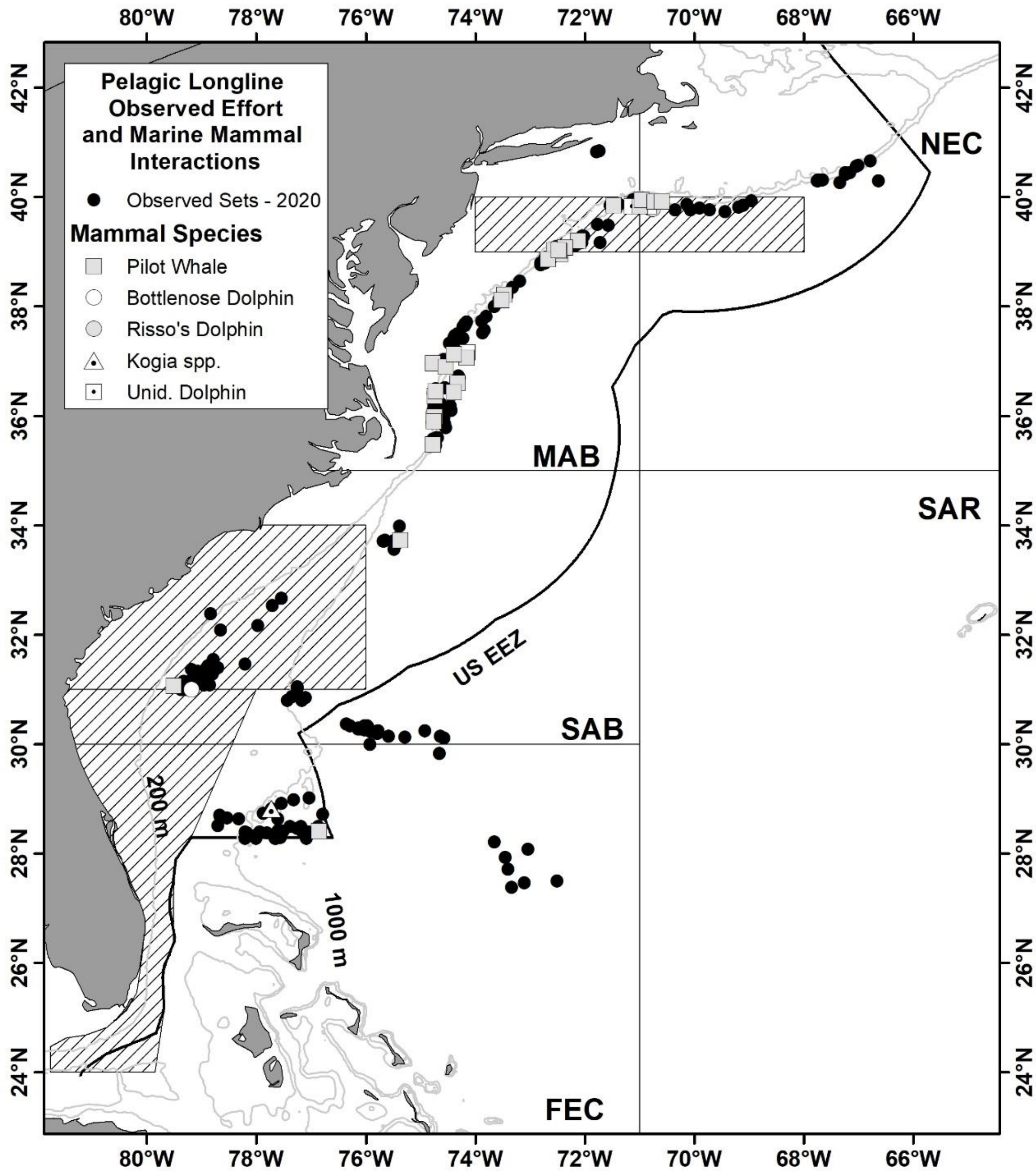


Figure 41. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2016. Closed areas in the DeSoto Canyon instituted in 2001 are shown as hatched areas.

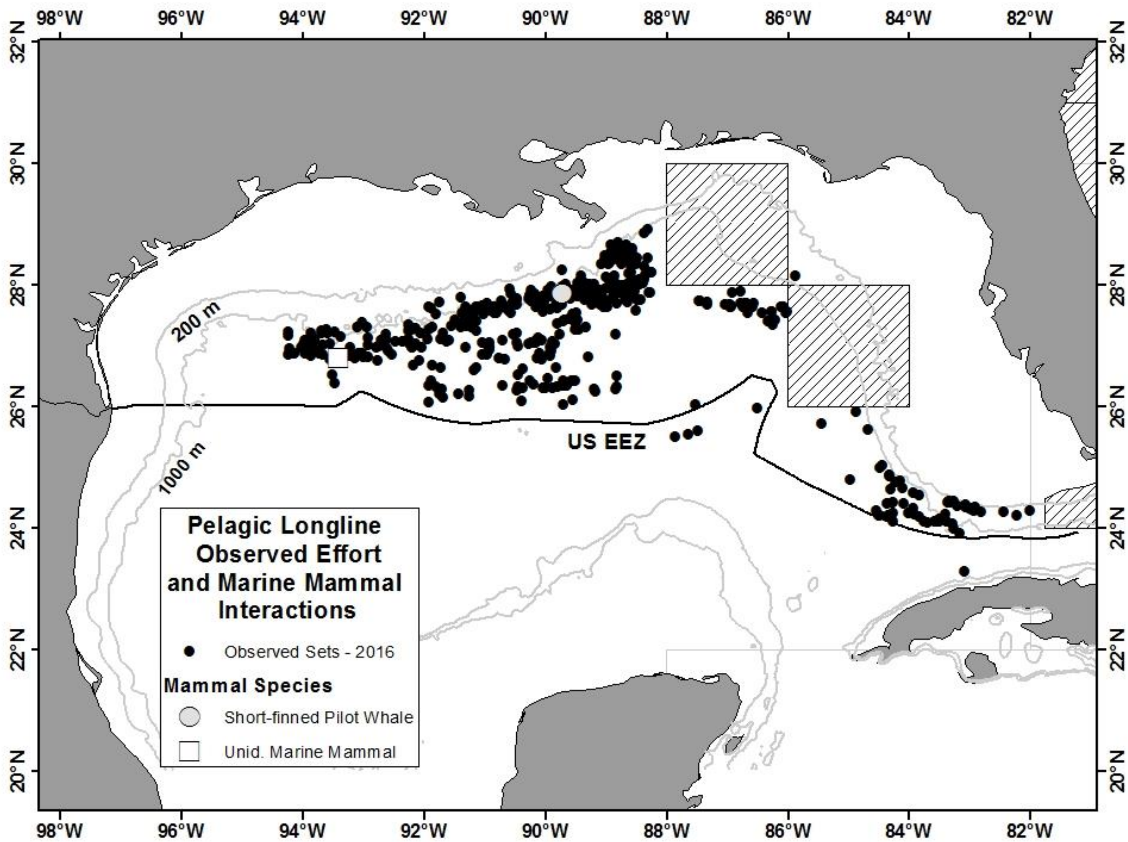


Figure 42. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2017. Closed areas in the DeSoto Canyon instituted in 2001 are shown as hatched areas.

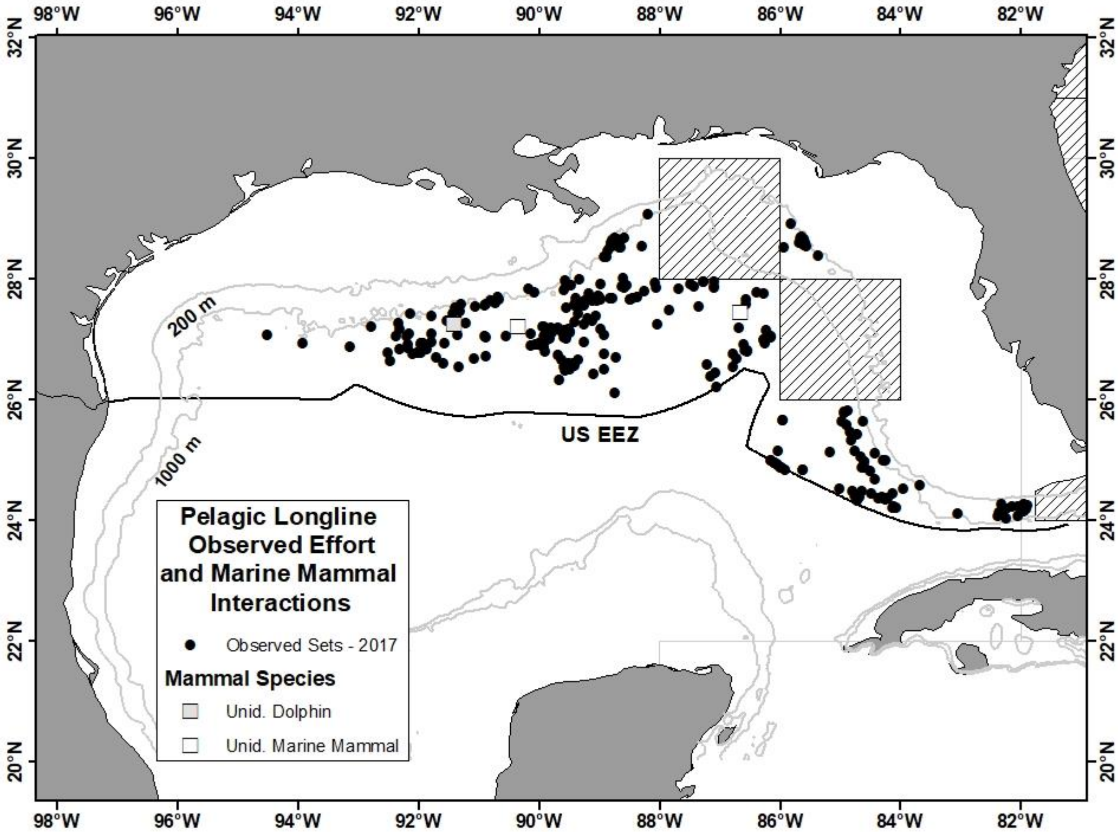


Figure 43. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2018. Closed areas in the DeSoto Canyon instituted in 2001 are shown as hatched areas.

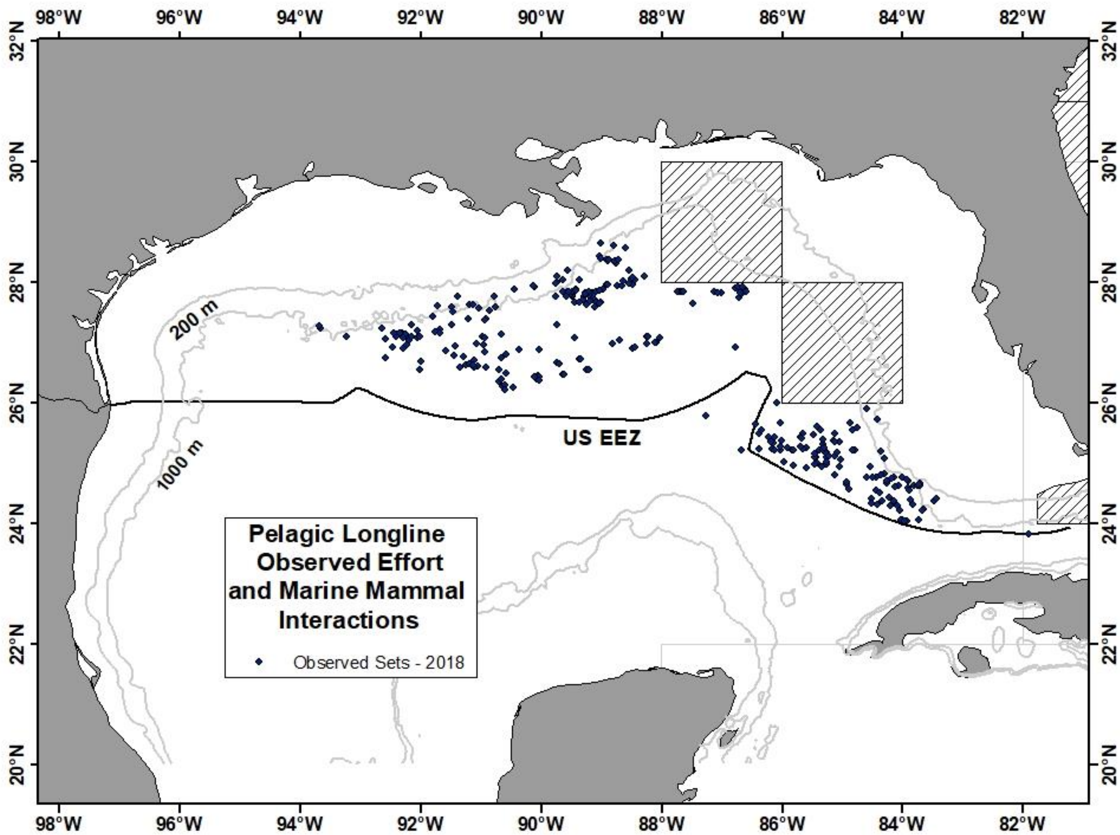


Figure 44. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2019. Closed areas in the DeSoto Canyon instituted in 2001 are shown as hatched areas.

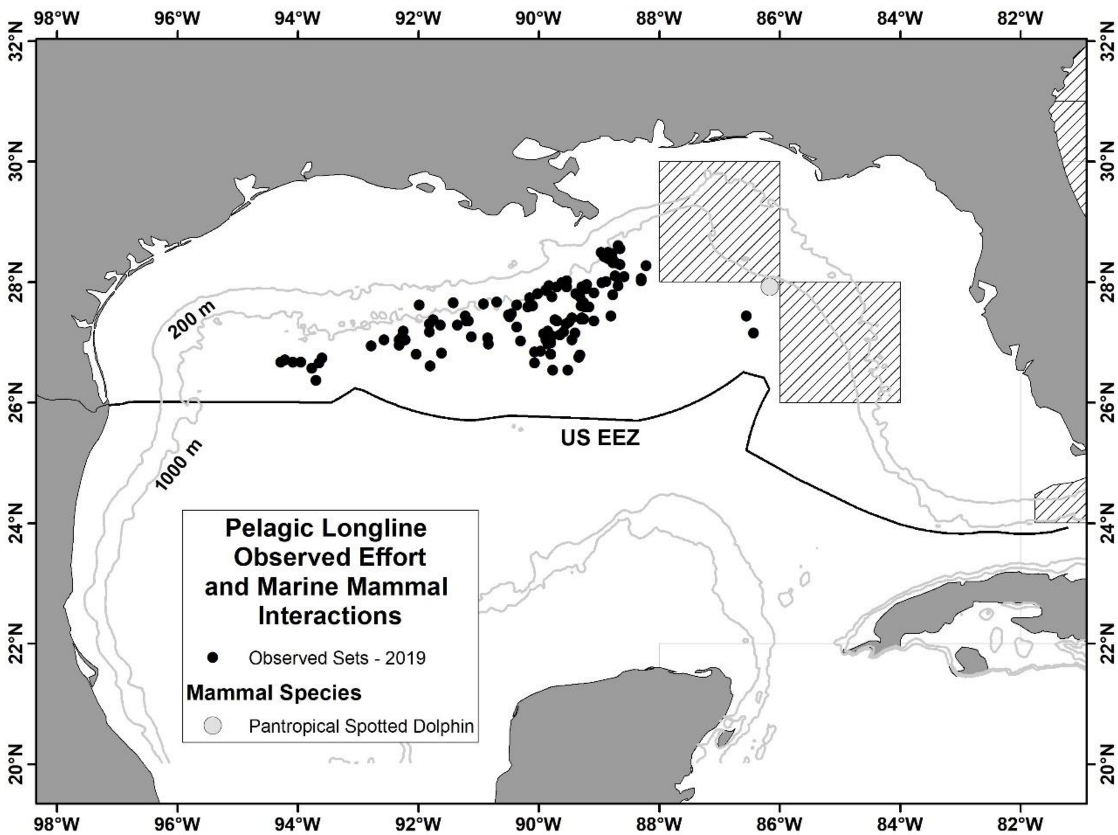
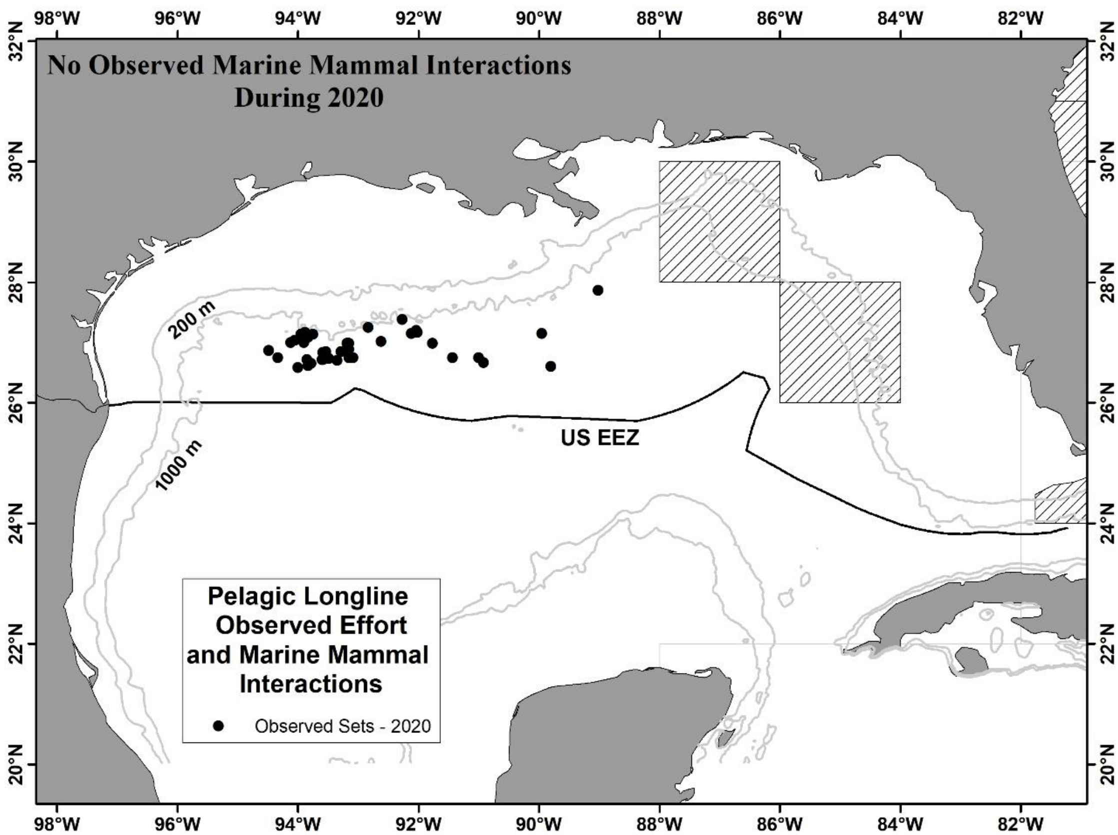


Figure 45. Observed sets in the Pelagic longline fishery in the Gulf of Mexico during 2020. Closed areas in the DeSoto Canyon instituted in 2001 are shown as hatched areas.



Appendix IV: Table A. Surveys.

Survey Number	Year(s)	Time of Year	Platform	Track Line Length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference(s)
1	1982	year-round	Plane	211,585	Cape Hatteras, NC to Nova Scotia, (continental shelf & shelf edge waters)	CETAP	Line transect analyses of distance data	N	CETAP 1982
2	1990	Aug	Ship (Chapman)	2,067	Cape Hatteras, NC to Southern New England (north wall of Gulf Stream)	NEC	One team data analyzed by DISTANCE	N	NMFS 1990
3	1991	Jul–Aug	Ship (Abel-J)	1,962	Gulf of Maine, lower Bay of Fundy, southern Scotian Shelf	NEC	Two independent team data analyzed with modified direct duplicate method	Y	Palka 1995
4	1991	Aug	Boat (Sneak Attack)	640	Inshore bays of Maine	NEC	One team data analyzed by DISTANCE	Y	Palka 1995
5	1991	Aug–Sep	Plane 1 (AT-11)	9,663	Cape Hatteras, NC to Nova Scotia (continental shelf & shelf edge waters)	NEC/SEC	One team data analyzed by DISTANCE	N	NMFS 1991
6	1991	Aug–Sep	Plane 2 (Twin Otter)		Cape Hatteras, NC to Nova Scotia (continental shelf & shelf edge waters)	NEC/SEC	One team data analyzed by DISTANCE	N	NMFS 1991
7	1991	Jun–Jul	Ship (Chapman)	4,032	Cape Hatteras to Georges Bank, (between 200 & 2,000m isobaths)	NEC	One team data analyzed by DISTANCE	N	Waring *et al.* 1992; Waring 1998
8	1992	Jul–Sep	Ship (Abel-J)	3,710	N. Gulf of Maine & lower Bay of Fundy	NEC	Two independent team data analyzed with modified direct duplicate method	Y	Smith *et al.* 1993
9	1993	Jun–Jul	Ship (Delaware II)	1,874	S. edge of Georges Bank, across the Northeast Channel, to the SE edge of the Scotian Shelf	NEC	One team data analyzed by DISTANCE		NMFS 1993
10	1994	Aug–Sep	Ship (Relentless)	534	Georges Bank (shelf edge & slope waters)	NEC	One team data analyzed by DISTANCE	N	NMFS 1994
11	1995	Aug–Sep	Plane (Skymaster)	8,427	Gulf of St. Lawrence	DFO	One team data analyzed using Quenouille's Jackknife Bias Reduction Method that modeled the left truncated sighting curve	N	Kingsley and Reeves 1998

Survey Number	Year(s)	Time of Year	Platform	Track Line Length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference(s)
12	1995	Jul–Sep	2 Ships (Abel-J & Pelican) & Plane (Twin Otter)	32,600	Virginia to the mouth of the Gulf of St. Lawrence	NEC	Ship: Two independent team data analyzed with modified direct duplicate method. Plane: One team data analyzed by DISTANCE.	Y/N	Palka 1996
13	1996	Jul–Aug	Plane	3,993	Northern Gulf of St. Lawrence	DFO	Quenouille's Jackknife Bias Reduction Method on line-transect methods that modeled the left truncated sighting curve	N	Kingsley and Reeves 1998
14	1998	Jul–Aug	Ship	4,163	South of Maryland	SEC	One team data analyzed by DISTANCE	N	Mullin and Fulling 2003
15	1998	Aug–Sep	Plane		Gulf of St. Lawrence	DFO			Kingsley and Reeves 1998
16	1998	Jul–Sep	Ship (Abel-J) & Plane (Twin Otter)	15,900	North of Maryland	NEC	Ship: Two independent team data analyzed with the modified direct duplicate or Palka & Hammond analysis methods, depending on the presence of responsive movement. Plane: One team data analyzed by DISTANCE.	Y	
17	1999	Jul–Aug	Ship (Abel-J) & Plane (Twin Otter)	6,123	South of Cape Cod to mouth of Gulf of St. Lawrence	NEC	Ship: Two independent team data analyzed with modified direct duplicate or Palka & Hammond analysis methods, depending on the presence of responsive movement. Plane: Circle-back data pooled with aerial data collected in 1999, 2002, 2004, 2006, 2007, and 2008 to calculate pooled g(0)'s and year-species specific abundance estimates for all years except 2008.	Y	
18	2002	Jul–Aug	Plane (Twin Otter)	7,465	Georges Bank to Maine	NEC	Same as for plane in survey 17	Y	Palka 2006
19	2002	Feb–Apr	Ship (Gunter)	4,592	SE US continental shelf - Delaware to Florida	SEC	One team data analyzed by DISTANCE	N	
20	2002	Jun–Jul	Plane	6,734	Florida to New Jersey	SEC	Two independent team data analyzed with modified direct duplicate method	Y	
21	2004	Jun–Aug	Ship (Gunter)	5,659	Florida to Maryland	SEC	Two independent team data analyzed with modified direct duplicate method	Y	Garrison *et al.* 2010
22	2004	Jun–Aug	Ship (Endeavor) & plane (Twin Otter)	10,761	Maryland to Bay of Fundy	NEC	Same methods used in survey 17	Y	Palka 2006
23	2006	Aug	Plane (Twin Otter)	10,676	Georges Bank to Bay of Fundy	NEC	Same as for plane in survey 17	Y	Palka 2005

Survey Number	Year(s)	Time of Year	Platform	Track Line Length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference(s)
24	2007	Aug	Ship (Bigelow) & Plane (Twin Otter)	8,195	Georges Bank to Bay of Fundy	NEC	Ship: Tracker data analyzed by DISTANCE. Plane: Same as for plane in survey 17	Y	Palka 2005
25	2007	Jul–Aug	Plane	46,804	Nova Scotia to Newfoundland	DFO	Uncorrected counts	N	Lawson and Gosselin 2009
26	2008	Aug	Plane (Twin Otter)	6,267	New York to Maine	NEC	Same as for plane in survey 17	Y	Palka 2005
27	2001	May–Jun	Plane		Maine Coast	NEC, UM	Corrected counts	N	Gilbert *et al.* 2005
28	1999	Mar	Plane		Cape Cod	NEC	Uncorrected counts	N	Barlas 1999
29	1983–1986	1983 (Fall), 1984 (Winter, Spring, Summer), 1985 (Summer, Fall), 1986 (Winter)	Plane (Beechcraft D-18S, modified with a bubblenose)	103,490	Northern Gulf of Mexico bays & sounds (coastal waters from shoreline to 18m isobath, & OCS waters from 18m isobath to 9.3km past the 18m isobath)	SEC	One team data analyzed with line-transect theory	N	Scott *et al.* 1989
30	1991–1994	Apr–Jun	Ship (Oregon II)	22,041	Northern Gulf of Mexico (from 200m to U.S. EEZ)	SEC	One team data analyzed by DISTANCE	N	Hansen *et al.* 1995
31	1992–1993	Sep–Oct	Plane (Twin Otter)		Northern Gulf of Mexico bays & sounds (coastal waters from shoreline to 18m isobath, & OCS waters from 18m isobath to 9.3km past the 18m isobath)	GOMEX92, GOMEX93	One team data analyzed by DISTANCE	N	Blaylock and Hoggard 1994
33	1996–1997, 1999–2001	Apr–Jun	Ship (Oregon II & Gunter)	12,162	Northern Gulf of Mexico (from 200m to U.S. EEZ)	SEC	One team data analyzed by DISTANCE	N	Mullin and Fulling 2004
34	1998–2001	End of Aug–Early Oct	Ship (Gunter & Oregon II)	2,196	Northern Gulf of Mexico (OCS waters from 20–200 m)	SEC	One team data analyzed by DISTANCE	N	Fulling *et al.* 2003
36	2004	12Jan–13 Jan	Helicopter		Sable Island	DFO	Pup count	na	Bowen *et al.* 2007
37	2004		Plane		Gulf of St Lawrence & Nova Scotia Eastern Shore	DFO	Pup count	na	Hammill 2005

Survey Number	Year(s)	Time of Year	Platform	Track Line Length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference(s)
38	2009	10Jun–13Aug	Ship	4,600	Northern Gulf of Mexico (from 200m to U.S. EEZ)	SEC	One team data analyzed by DISTANCE		
39	2007	17Jul–08Aug	Plane		Northern Gulf of Mexico (from shore to 200m, majority of effort 0–20m)	SEC	One team data analyzed by DISTANCE		
40	2011	04Jun–01Aug	Ship (Bigelow)	3,107	Virginia to Massachusetts (waters that were deeper than the 100m depth contour out to beyond the US EEZ)	NEC	Two-independent teams, both using big-eyes. Analyzed using DISTANCE, the independent observer option assuming point independence	Y	Palka 2012
41	2011	07Aug–26Aug	Plane (Twin Otter)	5,313	Massachusetts to New Brunswick, Canada (waters north of New Jersey & shallower than the 100m depth contour, through the US & Canadian Gulf of Maine & up to & including the lower Bay of Fundy)	NEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	Palka 2012
42	2011	19Jun–01Aug	Ship (Gunter)	4,445	Florida to Virginia	SEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	Garrison 2016
43	2012	May–Jun	Plane		Maine Coast	NEC	Corrected counts	N	Waring *et al.* 2015
44	1992	Jan–Feb	Ship (Oregon II)	3,464	Cape Canaveral to Cape Hatteras, US EEZ	SEC		N	NMFS 1992
45	2010	24Jul–14Aug	Plane	7,944	Southeastern Florida to Cape May, New Jersey	SEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.		
46	2011	06Jul–29Jul	Plane	8,665	Southeastern Florida to Cape May, New Jersey	SEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.		Garrison 2016

Survey Number	Year(s)	Time of Year	Platform	Track Line Length (km)	Area	Agency/ Program	Analysis	Corrected for g(0)	Reference(s)
47	2016	27Jun–25Aug	Ship & Plane	5,354	Central Virginia to the lower Bay of Fundy	NEC	Two-independent teams. Analyzed using DISTANCE, the independent observer option assuming point independence.		Palka 2020
48	2016	30Jun–19Aug	Ship & Plane	4,399	Central Florida to Virginia	SEC	Two-independent teams. Analyzed using DISTANCE, the independent observer option assuming point independence.		Garrison 2020
49	2016	Aug & Sep	Plane	50,160	Gulf of St. Lawrence, Bay of Fundy, Scotian Shelf, Newfoundland, Labrador	DFO	NAISS		Lawson and Gosselin 2018
50	2017, 2018	02Jul–25Aug 2017, 11Aug–06Oct 2018	Ship (Gunter)	13,775	Northern Gulf of Mexico (waters from 200m to U.S. EEZ)	SEC	Two-independent teams. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	Garrison *et al.* 2020
51	2017, 2018	29Jun–17Aug 2017 18Jan–14Mar 2018 12Oct–28Nov 2018	Plane	14,590 km 8,046 km 10,781 km	Northern Gulf of Mexico (from shore to 200m, majority of effort 0–20m)	SEC	Two-independent teams, both using naked eye in the same plane. Analyzed using DISTANCE, the independent observer option assuming point independence.	Y	Garrison *et al.* 2021

Appendix IV: Table B. Abundance Estimates.

"Survey Number" refers to surveys described in Table A. "Best" estimate for each species is in bold font.

Species	Stock	Year	Nest	CV	Survey Number	Notes
Humpback Whale	Gulf of Maine	1992	501			Minimum population size estimated from photo-ID data
		1993	652	0.29		YONAH sampling (Clapham *et al.* 2003)
		1997	497			Minimum population size estimated from photo-ID data
		1999	902	0.45	17	
		2002	521	0.67	18	Palka 2006
		2004	359	0.75	22	Palka 2006
		2006	847	0.55	23	Palka 2005
		2008	823			Mark-recapture estimate (Robbins 2010)
		2011	335	0.42	40+41	Palka 2012
		2015	896			Minimum population size estimated from photo-ID data
		2016	2,368			
		2016	**1,396**	**na**		State-space mark-recapture (Pace 2017)
Fin Whale	Western North Atlantic	1995	2,200	0.24	12	Palka 1996
		1999	2,814	0.21	18	Palka 2006
		2002	2,933	0.49	18	Palka 2006
		2004	1,925	0.55	22	Palka 2006
		2006	2,269	0.37	23	Palka 2005
		2007	3,522	0.27	25	Lawson and Gosselin 2009
		2011	1,595	0.33	40+41	Palka 2012
		2011	23	0.87	42	
		2011	1,618	0.33	40+41+42	Estimate summed from north and south surveys
		2016	3,006	0.40	47+48	Garrison 2020; Palka 2020
		2016	2,235	0.41	49	Bay of Fundy/Scotian Shelf (Lawson and Gosselin 2018)
		2016	2,177	0.47	49	Newfoundland/Labrador (Lawson and Gosselin 2018)
		2016	**7,418**	**0.25**	**47+48+49**	
Sei Whale	Nova Scotia Stock	1977	1,393–2,248			Based on tag-recapture data (Mitchell and Chapman 1977)
		1977	870			Based on census data (Mitchell and Chapman 1977)
		1982	280		1	CETAP 1982
		2002	71	1.01	18	Palka 2006
		2004	386	0.85	22	Palka 2006
		2006	207	0.62	23	Palka 2005
		2011	357	0.52	40+41	Palka 2012
		2010–2013	**6,292**	**1.02**		Springtime average abundance estimate generated from spatially- and temporally-explicit density models derived from visual two-team abundance survey data collected between 2010 and 2013 (Palka *et al.* 2017)

Species	Stock	Year	Nest	CV	Survey Number	Notes
		1999─2013	627	0.14		Spring habitat-based density estimates (Roberts *et al*. 2016)
		1995─2013	717	0.30		Summer habitat-based density estimates (Roberts *et al*. 2016)
		2016	28	0.55	47	Palka 2016
Minke Whale	Canadian East Coast	1982	320	0.23	1	CETAP 1982
		1992	2,650	0.31	3+8	
		1993	330	0.66	9	
		1995	2,790	0.32	12	Palka 1996
		1995	1,020	0.27	11	
		1996	620	0.52	13	
		1999	2,998	0.19	17	
		2002	756	0.9	18	Palka 2006
		2004	600	0.61	22	Palka 2006
		2006	3,312	0.74	23	
		2007	20,741	0.3	25	Lawson and Gosselin 2009
		2011	2,591	0.81	40+41	Palka 2012
		2016	5,036	0.68	47	Palka 2020
		2016	6,158	0.40	49	Bay of Fundy/Scotian Shelf (Lawson and Gosselin 2018)
		2016	13,008	0.46	49	Newfoundland/Labrador (Lawson and Gosselin 2018)
		2016	**24,202**	**0.30**	**47+49**	
Sperm Whale	North Atlantic	1982	219	0.36	1	CETAP 1982
		1990	338	0.31	2	
		1991	736	0.33	7	Waring *et al.*1992, Warring 1998
		1991	705	0.66	6	
		1991	337	0.5	5	
		1993	116	0.4	9	
		1994	623	0.52	10	
		1995	2,698	0.67	12	Palka 1996
		1998	2,848	0.49	16	
		1998	1,181	0.51	14	Mullin and Fulling 2003
		2004	2,607	0.57	22	Palka 2006
		2004	2,197	0.47	21	Garrison *et al.* 2010
		2004	4,804	0.38	21+22	Estimate summed from north and south surveys
		2011	1,593	0.36	40+41	Palka 2012
		2011	695	0.39	42	
		2011	2,288	0.28	40+41+42	Estimate summed from north and south surveys
		2016	3,321	0.35	47	Palka 2020
		2016	1,028	0.35	48	Garrison 2020

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2016	**4,349**	**0.28**	**47+48**	Estimate summed from north and south surveys
***Kogia* spp.**	Western North Atlantic	1998	115	0.61	16	
		1998	580	0.57	14	Mullin and Fulling 2003
		2004	358	0.44	22	Palka 2006
		2004	37	0.75	21	Garrison *et al.* 2010
		2004	395	0.4	21+22	Estimate summed from north and south surveys
		2011	1,783	0.62	40+41	Palka 2012
		2011	2,002	0.69	42	
		2011	3,785	0.47	40+41+42	Estimate summed from north and south surveys
		2016	4,548	0.49	47	Palka 2020
		2016	3,202	0.59	48	Garrison 2020
		2016	7,750	0.38	47+48	Estimate summed from north and south surveys
Beaked Whales	Western North Atlantic	1982	120	0.71	1	CETAP 1982
		1990	442	0.51	2	
		1991	262	0.99	7	Waring *et al.*1992, Warring 1998
		1991	370	0.65	6	
		1991	612	0.73	5	
		1993	330	0.66	9	
		1994	99	0.64	10	
		1995	1,519	0.69	12	Palka 1996
		1998	2,600	0.4	16	
		1998	541	0.55	14	Mullin and Fulling 2003
		2004	2,839	0.78	22	Palka 2006
		2004	674	0.36	21	Garrison *et al.* 2010
		2004	3,513	0.63	21+22	Estimate summed from north and south surveys
		2006	922	1.47	23	
		2011	5,500	0.67	40+41	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*; Palka 2012)
		2011	1,592	0.67	42	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*)
		2011	7,092	0.54	40+41+42	2011 estimates are for *Mesoplodon* spp. beaked whales alone (not including *Ziphias*); Estimate summed from north and south surveys
		2016	6,760	0.37	47	Palka 2020
		2016	3,347	0.29	48	Garrison 2020
		2016	10,107	0.27	47+48	Estimate summed from north and south surveys
Cuvier's Beaked Whale	Western North Atlantic	2011	4,962	0.37	40+41	Palka 2012
		2011	1,570	0.65	42	
		2011	6,532	0.32	40+41+42	Estimate summed from north and south surveys

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2016	3,897	0.47	47	Palka 2020
		2016	1,847	0.49	48	Garrison 2020
		2016	**5,744**	**0.36**	**47+48**	Estimate summed from north and south surveys
Risso's Dolphin	Western North Atlantic	1982	4,980	0.34	1	CETAP 1982
		1991	11,017	0.58	7	Waring *et al.*1992, Warring 1998
		1991	6,496	0.74	5	
		1991	16,818	0.52	6	
		1993	212	0.62	9	
		1995	5,587	1.16	12	Palka 1996
		1998	18,631	0.35	17	
		1998	9,533	0.5	15	
		1998	28,164	0.29	15+17	Estimate summed from north and south surveys
		2002	69,311	0.76	18	Palka 2006
		2004	15,053	0.78	21	Garrison *et al.* 2010
		2004	5,426	0.54	22	Palka 2006
		2004	20,479	0.59	21+22	Estimate summed from north and south surveys
		2006	14,408	0.38	23	
		2011	15,197	0.55	40+41	Palka 2012
		2011	3,053	0.44	42	
		2011	18,250	0.46	40+41+42	Estimate summed from north and south surveys
		2016	7,245	0.44	48	Garrison 2020
		2016	22,175	0.23	47	Palka 2020
		2016	6,073	0.45	49	Lawson and Gosselin 2018
		2016	**35,493**	**0.19**	**47+48+49**	
Pilot Whale	Western North Atlantic	1951	50,000			Derived from catch data from 1951–1961 drive fishery (Mitchell 1974)
		1975	43,000–96,000			Derived from population models (Mercer 1975)
		1982	11,120	0.29	1	CETAP 1982
		1991	3,636	0.36	7	Waring *et al.*1992, Warring 1998
		1991	3,368	0.28	5	
		1991	5,377	0.53	6	
		1993	668	0.55	9	
		1995	8,176	0.65	12	Palka 1996
		1995	9,776	0.55	12+16	Sum of US (#12) and Canadian (#16) surveys
		1998	1,600	0.65	16	
		1998	9,800	0.34	17	
		1998	5,109	0.41	15	

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2002	5,408	0.56	18	Palka 2006
		2004	15,728	0.34	22	Palka 2006
		2004	15,411	0.43	21	Garrison *et al.* 2010
		2004	31,139	0.27	21+22	Estimate summed from north and south surveys
		2006	26,535	0.35	23	Estimate summed from north and south surveys
		2007	16,058	0.79	25	Long-finned pilot whales (Lawson and Gosselin 2009)
		2011	5,636	0.63	40+41	Long-finned pilot whales
		2011	11,865	0.57	40+41	Unidentified pilot whales
		2011	4,569	0.57	40+41	Short-finned pilot whales
		2011	16,946	0.43	42	Short-finned pilot whales
		2011	21,515	0.37	40+41+42	Best estimate for short-finned pilot whales alone; Estimate summed from north and south surveys
		2016	3,810	0.42	47	Short-finned pilot whales (Garrison and Palka 2018)
		2016	25,114	0.27	48	Short-finned pilot whales (Garrison and Palka 2018)
		2016	**28,924**	**0.24**	**47+48**	Best estimate for short-finned pilot whales alone; Estimate summed from north and south surveys
		2016	10,997	0.51	47	Long-finned pilot whales (Garrison 2020; Palka 2020)
		2016	28,218	0.36	48	Long-finned pilot whales (Garrison 2020; Palka 2020)
		2016	**39,215**	**0.30**	**47+48**	Best estimate for long-finned pilot whales alone; Estimate summed from north and south surveys
Atlantic White-sided Dolphin	Western North Atlantic	1982	28,600	0.21	1	
		1992	20,400	0.63	2+7	
		1993	729	0.47	9	
		1995	27,200	0.43	12	Palka 1996
		1995	11,750	0.47	11	
		1996	560	0.89	13	
		1999	51,640	0.38	17	
		2002	109,141	0.3	18	Palka 2006
		2004	2,330	0.8	22	Palka 2006
		2006	17,594	0.3	23	
		2006	63,368	0.27	(18+23)/2	Average of #18 and #23
		2007	5,796	0.43	25	Lawson and Gosselin 2009
		2011	48,819	0.61	40+41	Palka 2012
		2016	31,912	0.61	47	Palka 2020
		2016	61,321	1.04	49	Canadian part of Gulf of Maine and all of Gulf of St. Lawrence population (Lawson and Gosselin 2018)
		2016	**93,233**	**0.71**	**47+49**	
	Western North Atlantic	1982	573	0.69	1	CETAP 1982
			5,500			Alling and Whitehead 1987

Species	Stock	Year	Nest	CV	Survey Number	Notes
White-beaked Dolphin		1982	3,486	0.22		Alling and Whitehead 1987
		2006	2,003	0.94	23	
		2007	11,842		25	
		2008			26	
		2016	**536,016**	**0.31**	**49**	Lawson and Gosselin 2018
Common Dolphin	Western North Atlantic	1982	29,610	0.39	1	
		1991	22,215	0.4	7	Waring *et al.*1992; Warring 1998
		1993	1,645	0.47	9	
		1995	6,741	0.69	12	Palka 1996
		1998	30,768	0.32	17	
		1998	0		15	
		2002	6,460	0.74	18	
		2004	90,547	0.24	22	Palka 2006
		2004	30,196	0.54	21	Garrison *et al.* 2010
		2004	120,743	0.23	21+22	Estimate summed from north and south surveys
		2006	84,000	0.36	24	
		2007	173,486	0.55	25	Lawson and Gosselin 2009
		2011	67,191	0.29	40+41	Palka 2012
		2011	2,993	0.87	42	
		2011	70,184	0.28	40+41+42	Estimate summed from north and south surveys
		2016	80,227	0.31	47	Palka 2020
		2016	900	0.57	48	Garrison 2020
		2016	48,574	0.48	49	Newfoundland/Labrador (Lawson and Gosselin 2018)
		2016	43,124	0.28	49	Bay of Fundy/Scotian Shelf (Lawson and Gosselin 2018)
		2016	**172,825**	**0.21**	**47+48+49**	Estimate summed from north, south and Canadian surveys
Atlantic Spotted Dolphin	Western North Atlantic	1982	6,107	0.27	1	CETAP 1982
		1995	4,772	1.27	12	Palka 1996
		1998	32,043	1.39	16	
		1998	14,438	0.63	14	Mullin and Fulling 2003
		2004	3,578	0.48	22	Palka 2006
		2004	47,400	0.45	21	Garrison *et al.* 2010
		2004	50,978	0.42	21+22	Estimate summed from north and south surveys
		2011	26,798	0.66	40+41	Palka 2012
		2011	17,917	0.42	42	
		2011	44,715	0.43	40+41+42	Estimate summed from north and south surveys
		2016	8,247	0.24	47	Palka 2020
		2016	31,674	0.33	48	Garrison 2020

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2016	39,921	0.27	47+48	Estimate summed from north and south surveys
Pantropical Spotted Dolphin	Western North Atlantic	1982	6,107	0.27	1	CETAP 1982
		1995	4,772	1.27	12	Palka 1996
		1998	343	1.03	16	
		1998	12,747	0.56	14	Mullin and Fulling 2003
		2004	0		22	Palka 2006
		2004	4,439	0.49	21	Garrison *et al.* 2010
		2004	4,439	0.49	21+22	Estimate summed from north and south surveys
		2011	0	0	40+41	Palka 2012
		2011	3,333	0.91	42	
		2011	3,333	0.91	40+41+42	Estimate summed from north and south surveys
		2016	0	-	47	Palka 2020
		2016	6,593	0.52	48	Garrison 2020
		2016	6,593	0.52	47+48	Estimate summed from north and south surveys
Striped Dolphin	Western North Atlantic	1982	36,780	0.27	1	
		1995	31,669	0.73	12	Palka 1996
		1998	39,720	0.45	16	
		1998	10,225	0.91	14	Mullin and Fulling 2003
		2004	52,055	0.57	22	
		2004	42,407	0.53	21	Garrison *et al.* 2010
		2004	94,462	0.4	21+22	Estimate summed from north and south surveys
		2011	46,882	0.33	40+41	Palka 2012
		2011	7,925	0.66	42	
		2011	54,807	0.3	40+41+42	Estimate summed from north and south surveys
		2016	42,783	0.25	47	Palka 2020
		2016	24,163	0.66	48	Garrison 2020
		2016	67,036	0.29	47+48	Estimate summed from north and south surveys
Rough-toothed Dolphin	Western North Atlantic	2011	0	0	40+41	Palka 2012
		2011	271	1	42	
		2011	**271**	**1**	**40+41+42**	Estimate summed from north and south surveys
Bottlenose Dolphin	Western North Atlantic: Offshore	1998	16,689	0.32	16	
		1998	13,085	0.4	14	Mullin and Fulling 2003
		2002	26,849	0.19	20	
		2002	5,100	0.41	18	Palka 2006
		2004	9,786	0.56	22	Palka 2006
		2004	44,953	0.26	21	Garrison *et al.* 2010
		2006	2,989	1.11	23	
		2011	26,766	0.52	40+41	Palka 2012

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2011	50,766	0.55	42	
		2011	77,532	0.4	40+41+42	Estimate summed from north and south surveys
		2016	17,958	0.33	47	Palka 2020
		2016	44,893	0.29	48	Garrison 2020
		2016	62,851	0.23	47+48	Estimate summed from north and south surveys
Bottlenose Dolphin	Western North Atlantic Northern Migratory Coastal	2016	6,639	0.41	48	Garrison *et al.* 2017
Bottlenose Dolphin	Western North Atlantic Southern Migratory Coastal	2016	3,751	0.60	48	Garrison *et al.* 2017
Bottlenose Dolphin	Western North Atlantic South Carolina/Georgia Coastal	2016	6,027	0.34	48	Garrison *et al.* 2017
Bottlenose Dolphin	Western North Atlantic Northern Florida Coastal	2016	877	0.49	48	Garrison *et al.* 2017
Bottlenose Dolphin	Western North Atlantic Central Florida Coastal	2016	1,218	0.35	48	Garrison *et al.* 2017
Bottlenose Dolphin	Western North Atlantic Bay, Sound and Estuarine (10 stocks)	Northern North Carolina Estuarine System (2013)	823	0.06		Gorgone *et al.* 2014
		Southern North Carolina Estuarine System (2006)	188	0.19		Urian *et al.* 2013
		Northern South Carolina Estuarine System (2016)	453	0.28		Silva *et al.* 2019
		Charleston Estuarine System (2005–2006)	289	0.03		Speakman *et al.* 2010
		Northern Georgia/Southern South Carolina Estuarine System	unknown	-		
		Central Georgia Estuarine System (2008–2009)	unknown	-		
		Southern Georgia Estuarine System (2008–2009)	unknown	-		
		Jacksonville Estuarine System	unknown	-		

Species	Stock	Year	Nest	CV	Survey Number	Notes
		Indian River Lagoon Estuarine System (2016–2017)	1,032	0.03		Durden *et al.* 2021
		Biscayne Bay	unknown	-		
Harbor Porpoise	Gulf of Maine, Bay of Fundy	1991	37,500	0.29	3	Palka 1995
		1992	67,500	0.23	8	Smith *et al.* 1993
		1995	74,000	0.2	12	Palka 1996
		1995	12,100	0.26	11	
		1996	21,700	0.38	14	Mullin and Fulling 2003
		1999	89,700	0.22	17	Survey discovered portions of the range not previously surveyed (Palka 2006)
		2002	64,047	0.48	21	Palka 2006
		2004	51,520	0.65	23	Palka 2006
		2006	89,054	0.47	24	
		2007	4,862	0.31	25	Lawson and Gosselin 2009
		2011	79,883	0.32	40+41	Palka 2012
		2016	75,079	0.38	47	Palka 2020
		2016	20,464	0.39	48	Garrison 2020
		2016	**95,543**	**0.31**	**47+48**	Estimate summed from north and south surveys
Harbor Seal	Western North Atlantic	2001	99,340	0.097	27	Gilbert *et al.* 2005
		2012	**75,834**	**0.15**	**43**	Waring *et al.* 2015
Gray Seal	Western North Atlantic	1999	5,611		28	Barlas 1999
		2001	1,731		27	Gilbert *et al.* 2005
		2004	52,500	0.15	37	Gulf of St Lawrence and Nova Scotia Eastern Shore
		2004	208,720–223,220	0.08–0.14	36	Sable Island
		2012	331,000	95%CI= 263,000-458,000		Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island (DFO 2013)
		2014	505,000	95%CI= 329,000–682,000		Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island (DFO 2014)
		2016	424,300	95%CI= 263,600–578,300		Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island (DFO 2017)
		2016	**27,131**	**95%CI= 18,768–39,221**		Derived from total population size to pup ratios in Canada applied to U.S. pup counts
Rice's Whale	Northern Gulf of Mexico	1991–1994	35	1.1	30	Hansen *et al.* 1995
		1996–2001	40	0.61	33	Mullin and Fulling 2004
		2003–2004	15	1.98	35	
		2009	33	1.07	38	
		2017–2018	51	0.50	50	Garrison *et al.* 2020a
	Northern Gulf of Mexico	1991–1994	530	0.31	30	Hansen *et al.* 1995

Species	Stock	Year	Nest	CV	Survey Number	Notes
Sperm Whale		1996–2001	1,349	0.23	33	Mullin and Fulling 2004
		2003–2004	1,665	0.2	35	
		2009	763	0.38	38	
		2017–2018	1,307	0.33	50	Garrison *et al.* 2020a
***Kogia* spp.**	Northern Gulf of Mexico	1991–1994	547	0.28	30	Hansen *et al.* 1995
		1996–2001	742	0.29	33	Mullin and Fulling 2004
		2003–2004	453	0.35	35	
		2009	186	1.04	38	
		2017–2018	336	0.35	50	Garrison *et al.* 2020a
Cuvier's Beaked Whale	Northern Gulf of Mexico	1991–1994	30	0.5	30	Hansen *et al.* 1995
		1996–2001	95	0.47	33	Mullin and Fulling 2004
		2003–2004	65	0.67	35	
		2009	74	1.04	38	
		2017–2018	18	0.75	50	Garrison *et al.* 2020a
***Mesoplodon* spp.**	Northern Gulf of Mexico	1996–2001	106	0.41	33	Mullin and Fulling 2004
		2003–2004	57	1.4	35	
		2009	149	0.91	38	
		2017–2018	98	0.46	50	Garrison *et al.* 2020a
Killer Whale	Northern Gulf of Mexico	1991–1994	277	0.42	30	Hansen *et al.* 1995
		1996–2001	133	0.49	33	Mullin and Fulling 2004
		2003–2004	49	0.77	35	
		2009	28	1.02	38	
		2017–2018	267	0.75	50	Garrison *et al.* 2020a
False Killer Whale	Northern Gulf of Mexico	1991–1994	381	0.62	30	Hansen *et al.* 1995
		1996–2001	1,038	0.71	33	Mullin and Fulling 2004
		2003–2004	777	0.56	35	
		2017–2018	494	0.79	50	Garrison *et al.* 2020a
Short-finned Pilot Whale	Northern Gulf of Mexico	1991–1994	353	0.89	30	Hansen *et al.* 1995
		1996–2001	2,388	0.48	33	Mullin and Fulling 2004
		2003–2004	716	0.34	35	
		2009	2,415	0.66	38	
		2017–2018	1,321	0.43	50	Garrison *et al.* 2020a
Melon-headed Whale	Northern Gulf of Mexico	1991–1994	3,965	0.39	30	Hansen *et al.* 1995
		1996–2001	3,451	0.55	33	
		2003–2004	2,283	0.76	35	

Species	Stock	Year	Nest	CV	Survey Number	Notes
		2009	2,235	0.75	38	
		2017–2018	1,749	0.68	50	Garrison *et al.* 2020a
Pygmy Killer Whale	Northern Gulf of Mexico	1991–1994	518	0.81	30	Hansen *et al.* 1995
		1996–2001	408	0.6	33	Mullin and Fulling 2004
		2003–2004	323	0.6	35	
		2009	152	1.02	38	
		2017–2018	613	1.15	50	Garrison *et al.* 2020a
Risso's Dolphin	Northern Gulf of Mexico	1991–1994	2,749	0.27	30	Hansen *et al.* 1995
		1996–2001	2,169	0.32	33	Mullin and Fulling 2004
		2003–2004	1,589	0.27	35	
		2009	2,442	0.57	38	
		2017–2018	1,974	0.46	50	Garrison *et al.* 2020a
Pantropical Spotted Dolphin	Northern Gulf of Mexico	1991–1994	31,320	0.2	30	Hansen *et al.* 1995
		1996–2001	91,321	0.16	33	Mullin and Fulling 2004
		2003–2004	34,067	0.18	35	
		2009	50,880	0.27	38	
		2017–2018	37,195	0.24	50	Garrison *et al.* 2020a
Striped Dolphin	Northern Gulf of Mexico	1991–1994	4,858	0.44	30	Hansen *et al.* 1995
		1996–2001	6,505	0.43	33	Mullin and Fulling 2004
		2003–2004	3,325	0.48	35	
		2009	1,849	0.77	38	
		2017–2018	1,817	0.56	50	Garrison *et al.* 2020a
Spinner Dolphin	Northern Gulf of Mexico	1991–1994	6,316	0.43	30	Hansen *et al.* 1995
		1996–2001	11,971	0.71	33	Mullin and Fulling 2004
		2003–2004	1,989	0.48	35	
		2009	11,441	0.83	38	
		2017–2018	2,991	0.54	50	Garrison *et al.* 2020a
Clymene Dolphin	Northern Gulf of Mexico	1991–1994	5,571	0.37	30	Hansen *et al.* 1995
		1996–2001	17,355	0.65	33	Mullin and Fulling 2004
		2003–2004	6,575	0.36	35	
		2009	129	1	38	
		2017–2018	513	1.03	50	Garrison *et al.* 2020a
Atlantic Spotted Dolphin	Northern Gulf of Mexico	Oceanic (1991–1994)	3,213	0.44	30	Hansen *et al.* 1995
		Oceanic (1996–2001)	175	0.84	33	Mullin and Fulling 2004
		OCS (1998–2001)	37,611	0.28	34	Abundance estimate is from 2000-2001 surveys only (from Fulling *et al.* 2003). Current best population size estimate is unknown because

Species	Stock	Year	Nest	CV	Survey Number	Notes
						data from the continental shelf portion of this species' range are more than 8 years old.
		Oceanic (2003–2004)	0	-	35	
		2009	2968	0.67	38	
		2017–2018	**21,506**	**0.26**	**50+51**	Garrison *et al.* 2020a and Garrison *et al.* 2021
Fraser's Dolphin	Northern Gulf of Mexico	1991–1994	127	0.9	30	Hansen *et al.* 1995
		1996–2001	726	0.7	33	
		2003–2004	0	-	35	
		2009	0	-	38	
		2017–2018	213	1.03	50	Garrison *et al.* 2020a
Rough-toothed Dolphin	Northern Gulf of Mexico	Oceanic (1991–1994)	852	0.31	30	
		Oceanic (1996–2001)	985	0.44	33	Mullin and Fulling 2004
		OCS (1998–2001)	1,145	0.83	34	Abundance estimate is from 2000-2001 surveys only (from Fulling *et al.* 2003). Current best population size estimate is unknown because data from the continental shelf portion of this species' range are more than 8 years old.
		Oceanic (2003–2004)	1,508	0.39	35	
		2009	624	0.99	38	
Bottlenose Dolphin	Northern Gulf of Mexico: Oceanic	1996–2001	2,239	0.41	33	Mullin and Fulling 2004
		2003–2004	3,708	0.42	35	
		2009	5,806	0.39	38	
		2017–2018	213	1.03	50	Garrison *et al.* 2020a
Bottlenose Dolphin	Northern Gulf of Mexico: Continental Shelf	1998–2001	17,777	0.32	34	Abundance estimate is from 2000-2001 surveys only (from Fulling *et al.* 2003). Current best population size estimate is unknown because data from the continental shelf are more than 8 years old.
		2017–2018	**63,280**	**0.11**	**51**	Garrison *et al.* 2021
Bottlenose Dolphin	Northern Gulf of Mexico: Coastal (3 stocks)	Eastern (1994)	9,912	0.12	32	
		Eastern (2007)	7,702	0.19	39	
		Eastern (2017–2018)	**16,407**	**0.17**	**51**	Garrison *et al.* 2021
		Northern (1993)	4,191	0.21	31	Current best population size estimate for this stock is unknown because data are more than 8 years old (Blaylock and Hoggard 1994)
		Northern (2007)	2,473	0.25	39	
		Northern (2017–2018)	**11,543**	**0.19**	**51**	Garrison *et al.* 2021

Species	Stock	Year	Nest	CV	Survey Number	Notes
		Western (1992)	3,499	0.21	31	Current best population size estimate for this stock is unknown because data are more than 8 years old (Blaylock and Hoggard 1994)
		Western (2017–2018)	**20,759**	**0.13**	**51**	Garrison *et al.* 2021
Bottlenose Dolphin	Northern Gulf of Mexico: Bay, Sound and Estuarine (32 stocks)	Choctawhatchee Bay (2007)	179	0.04		Conn *et al.* 2011
		St. Joseph Bay (2011)	142	0.17		Balmer *et al. 2018*
		Sarasota Bay, Little Sarasota Bay (2015)	158	0.27		Tyson and Wells 2016
		Florida Bay	unk	-		
		Mississippi River Delta (2017–2018)	**1,446**	**0.19**	**51**	Garrison *et al.* 2021
		Mississippi Sound, Lake Borgne, Bay Boudreau (2018)	**1,265**	**0.35**	**51**	Garrison *et al.* 2021
		Barataria Bay (2019)	**2,071**	**0.06**		Garrison *et al.* 2020b
		West Bay (2014–2015)	37	0.05		Ronje *et al.* 2020
		Galveston Bay, East Bay, Trinity Bay (2016)	**842**	**0.8**		Ronje *et al.* 2020
		Terrebonne Bay, Timbalier Bay (2016)	3,870	0.15		Litz *et al.* 2018
		St. Andrew Bay (2016)	199	0.09		Balmer *et al.* 2019
		Sabine Lake (2017)	122	0.19		Ronje *et al.* 2020
		Remaining 20 stocks	unknown	-	31	Current best population size estimate for each of these 20 stocks is unknown because data are more than 8 years old (Blaylock and Hoggard 1994)

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Appendix V: Fishery Bycatch Summaries -- Part A: By Fishery

Northeast Sink Gillnet

	Harbor Porpoise		Bottlenose Dolphin, Atlantic Offshore Stock		White-sided Dolphin		Common Dolphin		Risso's Dolphin		Long-finned Pilot Whale		Harbor Seal		Gray Seal		Harp Seal	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1990	2900	0.32	0	0	0	0	0	0	0	0	0	0	602	0.68	0	0	0	0
1991	2000	0.35	0	0	49	0.46	0	0	0	0	0	0	231	0.22	0	0	0	0
1992	1200	0.21	0	0	154	0.35	0	0	0	0	0	0	373	0.23	0	0	0	0
1993	1400	0.18	0	0	205	0.31	0	0	0	0	0	0	698	0.19	0	0	0	0
1994	2100	0.18	0	0	240	0.51	0	0	0	0	0	0	1330	0.25	19	0.95	861	0.58
1995	1400	0.27	0	0	80	1.16	0	0	0	0	0	0	1179	0.21	117	0.42	694	0.27
1996	1200	0.25	0	0	114	0.61	63	1.39	0	0	0	0	911	0.27	49	0.49	89	0.55
1997	782	0.22	0	0	140	0.61	0	0	0	0	0	0	598	0.26	131	0.5	269	0.5
1998	332	0.46	0	0	34	0.92	0	0	0	0	0	0	332	0.33	61	0.98	78	0.48
1999	270	0.28	0	0	69	0.7	146	0.97	0	0	0	0	1446	0.34	155	0.51	81	0.78
2000	507	0.37	132	1.16	26	1	0	0	15	1.06	0	0	917	0.43	193	0.55	24	1.57
2001	53	0.97	0	0	26	1	0	0	0	0	0	0	1471	0.38	117	0.59	26	1.04
2002	444	0.37	0	0	30	0.74	0	0	0	0	0	0	787	0.32	0	0	0	0
2003	592	0.33	0	0	31	0.93	0	0	0	0	0	0	542	0.28	242	0.47	0	0
2004	654	0.36	1[a]	na	7	0.98	0	0	0	0	0	0	792	0.34	504	0.34	303	0.3
2005	630	0.23	0	0	59	0.49	5	0.8	15	0.93	0	0	719	0.2	574	0.44	35	0.68
2006	514	0.31	0	0	41	0.71	20	1.05	0	0	0	0	87	0.58	248	0.47	65	0.66

	Harbor Porpoise		Bottlenose Dolphin, Atlantic Offshore Stock		White-sided Dolphin		Common Dolphin		Risso's Dolphin		Long-finned Pilot Whale		Harbor Seal		Gray Seal		Harp Seal	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2007	395	0.37	0	0	0	0	11	0.94	0	0	0	0	92	0.49	886	0.24	119	0.35
2008	666	0.48	0	0	81	0.57	34	0.77	0	0	0	0	242	0.41	618	0.23	238	0.38
2009	591	0.23	0	0	0	0	43	0.77	0	0	0	0	513	0.28	1063	0.26	415	0.27
2010	387	0.27	0	0	66	0.9	42	0.81	0	0	3	.82	540	0.25	1155	0.28	253	0.61
2011	273	0.2	0	0	18	0.43	64	0.71	0	0	0	0	343	0.19	1491	0.22	14	0.46
2012	277.3	0.59	0	0	9	0.92	95	0.4	6	0.87	0	0	252	0.26	542	0.19	0	0
2013	399	0.33	27	5	4	1.03	104	0.47	23	0.97	0	0	147	0.3	1127	0.2	22	0.75
2014	128	0.27	0	0	10	0.66	111	0.46	0	0	0	0	390	0.39	917	0.14	17	0.53
2015	177	0.28	0	0	0	0	55	0.54	0	0	0	0	474	0.17	1021	0.25	119	0.34
2016	125	0.34	0	0	0	0	80	0.38	0	0	0	0	245	0.29	498	0.33	85	0.5
2017	136	0.28	8	0.92	0	0	133	0.28	0	0	0	0	298	0.18	930	0.16	44	0.37
2018	92	0.52	0	0	0	0	93	0.45	0	0	0	0	188	0.36	1113	0.32	14	0.8
2019	195	0.22	2	0.99	0	0	5	0.68	5	0.7	0	0	316	0.15	2019	0.17	163	0.19
2020	121	0.22	1	0.99	0	0	50	0.25	2	1.01	0	0	261	0.14	1357	0.14	72	0.22

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/northeast-sink-gillnet-fishery-mmpa-list-fisheries.
[a] Unextrapolated mortalities
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Mid-Atlantic Sink Gillnet

	Harbor Porpoise		Bottlenose Dolphin, Atlantic Offshore Stock		White-sided Dolphin		Common Dolphin		Risso's Dolphin		Pilot Whale, Unidentified		Harbor Seal		Gray Seal		Harp Seal		Minke Whale	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	103	0.57	56	1.66	0	0	7.4	0.69	0	0	0	0	0	0	0	0	0	0	0	0
1996	311	0.31	64	0.83	0	0	43	0.79	0	0	0	0	0	0	0	0	0	0	0	0
1997	572	0.35	0	0	45	0.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	446	0.36	63	0.94	0	0	0	0	0	0	7	0	11	0.77	0	0	17	1.02	0	0
1999	53	0.49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	21	0.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	26	0.95	na	na	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	unk	na	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	76	1.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	137	0.91	0	0	0	0	0	0	0	0	0	0	15	0.86	69	0.92	0	0	0	0
2005	470	0.51	1[a]	na	0	0	0	0	0	0	0	0	63	0.67	0	0	0	0	0	0
2006	511	0.32	0	0	0	0	0	0	0	0	0	0	26	0.98	0	0	0	0	0	0
2007	58	1.03	0	0	0	0	0	0	34	0.73	0	0	0	0	0	0	38	0.9	0	0
2008	350	0.75	0	0	0	0	0	0	0	0	0	0	88	0.74	0	0	176	0.74	0	0
2009	201	0.55	0	0	0	0	0	0	0	0	0	0	47	0.68	0	0	0	0	0	0
2010	259	0.88	0	0	0	0	30	0.48	0	0	0	0	89	0.39	267	0.75	0	0	0	0
2011	123	0.41	0	0	0	0	29	0.53	0	0	0	0	21	0.67	19	0.60	0	0	0	0
2012	63.41	0.83	0	0	0	0	15	0.93	0	0	0	0	0	0	14	0.98	0	0	0	0
2013	19	1.06	26	0.95	0	0	62	0.67	0	0	0	0	0	0	0	0	0	0	0	0
2014	22	1.03	0	0	0	0	17	0.86	0	0	0	0	19	1.06	22	1.09	0	0	0	0

	Harbor Porpoise		**Bottlenose Dolphin, Atlantic Offshore Stock**		**White-sided Dolphin**		**Common Dolphin**		**Risso's Dolphin**		**Pilot Whale, Unidentified**		**Harbor Seal**		**Gray Seal**		**Harp Seal**		**Minke Whale**	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
2015	60	1.16	0	0	0	0	30	0.55	0	0	0	0	48	0.52	15	1.04	0	0	0	0
2016	23	0.64	0	0	0	0	7	0.97	0	0	0	0	18	0.95	7	0.93	0	0	0	0
2017	9	0.95	0	0	0	0	22	0.71	0	0	0	0	3	0.62	0	0	0	0	0	0
2018	0	0	0	0	0	0	8	0.91	0	0	0	0	26	0.52	0	0	0	0	0	0
2019	13	0.51	0	0	0	0	20	0.56	0	0	0	0	17	0.35	18	0.4	29	.84	0.2[a]	na
2020	16	0.63	0	0	0	0	30	0.55	0	0	0	0	9	0.43	9	0.72	2	1.01	0	0

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/mid-atlantic-gillnet-fishery-mmpa-list-fisheries. For bottlenose dolphin stocks not listed in this table (Northern Migratory Coastal Stock, Southern Migratory Coastal Stock, Northern NC Estuarine Stock, Southern NC Estuarine Stock), see Lyssikatos & Garrison 2018 and Lyssikatos 2021.

[a] Unextrapolated mortalities

na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

New England/North Atlantic Bottom Trawl

	Harbor Porpoise		Bottlenose Dolphin, Atlantic Offshore Stock		White-sided Dolphin		Common Dolphin		Risso's Dolphin, Atlantic		Pilot Whale, Unidentified		Long-finned Pilot Whale		Harbor Seal		Gray Seal		Harp Seal		Minke Whale	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	91	0.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	110	0.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	182	0.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	142	0.77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	93	1.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	137	0.34	27	0.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	161	0.34	30	0.3	0	0	21	0.27	0	0	0	0	0	0	49	1.1	0	0
2002	0	0	0	0	70	0.32	26	0.29	0	0	22	0.26	0	0	0	0	0	0	0	0	0	0
2003	*	*	0	0	216	0.27	26	0.29	0	0	20	0.26	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	200	0.30	26	0.29	0	0	15	0.29	0	0	0	0	0	0	0	0	0	0
2005	7.2	0.48	0	0	213	0.28	32	0.28	0	0	15	0.30	0	0	0	0	unk	unk	unk	unk	0	0
2006	6.5	0.49	0	0	40	0.50	25	0.28	0	0	14	0.28	0	0	0	0	0	0	0	0	0	0
2007	5.6	0.46	48	0.95	29	0.66	24	0.28	3	0.52	0	0	0	0	0	0	unk	unk	0	0	0	0
2008	5.6	0.97	19	0.88	13	0.57	6	0.99	2	0.56	0	0	21	0.51	0	0	16	0.52	0	0	2.9	0.73
2009	0	0	18	0.92	171	0.28	24	0.60	3	0.53	0	0	13	0.70	0	0	22	0.46	5	1.02	0	0
2010	0	0	4	0.53	37	0.32	114	0.32	2	0.55	0	0	30	0.43	0	0	30	0.34	0	0	0	0
2011	5.9	0.71	10	0.84	141	0.24	72	0.37	3	0.55	0	0	55	0.18	9	0.58	58	0.25	3	1.02	0	0
2012	0	0	0	0	27	0.47	40	0.54	0	0	0	0	33	0.32	3	1	37	0.49	0	0	0	0
2013	7	0.98	0	0	33	0.31	17	0.54	0	0	0	0	16	0.42	4	0.89	20	0.37	0	0	0	0
2014	5.5	0.86	0	0	16	0.5	17	0.53	4.2	0.91	0	0	32	0.44	11	0.63	19	0.45	0	0	0	0
2015	3.7	0.49	19	0.65	15	0.52	22	0.45	0	0	0	0	0	0	0	0	23	0.46	0	0	0	0
2016	0	0	33.5	0.89	28	0.46	16	0.46	17	0.88	0	0	29	0.58	0	0	0	0	0	0	0	0
2017	0	0	0	0	15	0.64	0	0	0	0	0	0	0	0	8.3	0	16	0.24	0	0	0	0
2018	0	0	0	0	0	0	28	0.54	0	0	0	0	0	0	0	0	32	0.42	0	0	0	0
2019	10.8	0.63	5.6	0.92	79	0.28	10	0.62	0	0	5.4	0.88	6.9	0.51	5.4	0.88	30	0.37	5.4	0.89	0	0
2020	3.6	0.63	1.9	0.92	31	0.26	13	0.43	0	0	1.8	0.62	0	0	4.6	0.68	25.8	0.26	1.8	0.89	0	0

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/northeast-bottom-trawl-fishery-mmpa-list-fisheries

na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

[a] Unextrapolated mortalities

Mid-Atlantic Bottom Trawl

	Bottlenose Dolphin, Atlantic Offshore Stock		White-sided Dolphin		Common Dolphin		Risso's Dolphin, Atlantic		Pilot Whale, Unidentified		Harbor Seal		Gray Seal	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1997	0	0	161	1.58	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	228	1.03	0	0	0	0
2000	0	0	27	0.17	0	0	0	0	0	0	0	0	0	0
2001	0	0	27	0.19	103	0.27	0	0	39	0.3	0	0	0	0
2002	0	0	25	0.17	87	0.27	0	0	38	0.36	0	0	0	0
2003	0	0	31	0.25	99	0.28	0	0	31	0.31	0	0	0	0
2004	0	0	26	0.2	159	0.3	0	0	35	0.33	0	0	0	0
2005	0	0	38	0.29	141	0.29	0	0	31	0.31	0	0	0	0
2006	0	0	3	0.53	131	0.28	0	0	37	0.34	0	0	0	0
2007	11	0.42	2	1.03	66	0.27	33	0.34	0	0	0	0	0	0
2008	16	0.36	0	0	23	1	39	0.69	0	0	0	0	0	0
2009	21	0.45	0	0	167	0.46	23	0.5	0	0	24	0.92	38	0.7
2010	20	0.34	0	0	21	0.96	54	0.74	0	0	11	1.1	0	0
2011	34	0.31	0	0	271	0.25	62	0.56	0	0	0	0	25	0.57
2012	16	1.00	0	0	323	0.26	8	1	0	0	23	1	30	1.1
2013	0	0	0	0	269	0.29	42	0.71	0	0	11	0.96	29	0.67
2014	25	0.66	9.7	0.94	329	0.29	21	0.93	0	0	10	0.95	7	0.96
2015	0	0	0	0	250	0.32	40	0.63	0	0	7.4	1.0	0	0
2016	7.3	0.93	0	0	177	0.33	39	0.56	0	0	0	0	26	0.57
2017	22.1	0.66	0	0	380	0.23	43	0.51	0	0	0	0	26	0.40
2018	6.33	0.91	0	0	205	0.21	0	0	0	0	5.6	0.94	56	0.58
2019	0	0	0	0	395	0.23	0	0	0	0	7.3	0.93	22	0.53
2020	9.5	0.55	0	0	333	0.14	18.4	0.51	0	0	4.3	0.67	34.7	0.35

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/mid-atlantic-bottom-trawl-fishery-mmpa-list-fisheries
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Northeast Mid-Water Trawl

	White-sided Dolphin		Common Dolphin		Pilot Whale, Unidentified		Long-finned Pilot Whale		Harbor Seal		Gray Seal	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	4.6	0.74	0	0	0	0	0	0
2001	unk	na	0	0	11	0.74	0	0	0	0	0	0
2002	unk	na	0	0	8.9	0.74	0	0	0	0	0	0
2003	22	0.97	0	0	14	0.56	0	0	0	0	0	0
2004	0	0	0	0	5.8	0.58	0	0	0	0	0	0
2005	9.4	1.03	0	0	1.1	0.68	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	16	0.61	0	0	0	0
2009	0	0	0	0	0	0	0	0	1.3	0.81	0	0
2010	0	0	1[a]	na	0	0	0	0	2[a]	na	0	0
2011	0	0	0	0	0	0	1	0	0	0	0	0
2012	0	0	1[a]	na	0	0	1	0	1[a]	na	1[a]	na
2013	0	0	0	0	0	0	3	0	0	0	1[a]	na
2014	0	0	0	0	0	0	4	na	1[a]	na	0	0
2015	0	0	0	0	0	0	0	na	2[a]	na	0	0
2016	0	0	0	0	0	0	3	na	1[a]	na	0	0
2017	0	0	0	0	0	0	0	na	0	na	0	0
2018	0	0	0	0	0	0	0	0	0	0	1[a]	na
2019	0	0	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0	0	0

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/northeast-mid-water-trawl-fishery-mmpa-list-fisheries

[a] Unextrapolated mortalities

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Mid-Atlantic Mid-Water Trawl

	White-sided Dolphin		Common Dolphin		Risso's Dolphin, Atlantic		Harbor Seal		Gray Seal	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0
2001	unk	na	0	0	0	0	0	0	0	0
2002	unk	na	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0
2004	22	0.99	0	0	0	0	0	0	0	0
2005	58	1.02	0	0	0	0	0	0	0	0
2006	29	0.74	0	0	0	0	0	0	0	0
2007	12	0.98	3.2	0.7	0	0	0	0	0	0
2008	15	0.73	0	0	1[a]	na	0	0	0	0
2009	4	0.92	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	1[a]	na	1[a]	na
2011	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/mid-atlantic-mid-water-trawl-includes-pair-trawl-fishery-mmpa

[a] Unextrapolated mortalities

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Pelagic Longline

	Pantropical Spotted Dolphin, GMex		Bottlenose Dolphin, Atlantic Offshore Stock		Common Dolphin		Risso's Dolphin, Atlantic		Risso's Dolphin, Gmex		Pilot Whale, Unidentified & Long-finned, Atlantic		Short-finned Pilot Whale, Atlantic		Beaked Whale, Unidentified	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1992	0	0	0	0	0	0	0	0	0	0	22	0.23	0	0	0	0
1993	0	0	0	0	0	0	13	0.19	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	7	1	0	0	137	0.44	0	0	0	0
1995	0	0	0	0	0	0	103	0.68	0	0	345	0.51	0	0	0	0
1996	0	0	0	0	0	0	99	1	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	57	1	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	22	1	0	0	381	0.79	0	0	0	0
2000	0	0	0	0	0	0	64	1	0	0	133	0.88	0	0	0	0
2001	0	0	0	0	0	0	69	0.57	0	0	79	0.48	0	0	0	0
2002	0	0	0	0	0	0	28	0.86	0	0	54	0.46	0	0	0	0
2003	0	0	0	0	0	0	40	0.63	0	0	21	0.77	0	0	5.3	1
2004	0	0	0	0	0	0	28	0.72	0	0	74	0.42	0	0	0	0
2005	0	0	0	0	0	0	3	1	0	0	212	0.21	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	185	0.47	0	0	0	0
2007	0	0	0	0	0	0	9	0.65	0	0	57	0.65	0	0	0	0
2008	0	0	0	0	0	0	16.8	0.73	8.3	0.63	0	0	80	0.42	0	0
2009	16	0.69	8.8	1	8.5	1	11.8	0.711	0	0	0	0	17	0.7	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0	127	0.78	0	0
2011	0	0	0	0	0	0	12	0.70	1.5	1	0	0	305	0.29	0	0
2012	0	0	62	0.68	0	0	15	1	30	1	0	0	170.1	0.33	0	0
2013	2.1	1	0	0	0	0	1.9	1	15	1	0	0	124	0.32	0	0
2014	0	0	0	0	0	0	7.7	1	0	0	9.6	0.43	233	0.24	0	0
2015	0	0	0	0	9.05	1	8.4	0.71	0	0	2.2	0.49	200	0.24	0	0
2016	0	0	0	0	0	0	16	0.57	0	0	1.1	0.6	111	0.31	0	0
2017	0	0	0	0	4.92	1	0.2	1	0	0	3.3	0.98	133	0.29	0	0

	Pantropical Spotted Dolphin, GMex		Bottlenose Dolphin, Atlantic Offshore Stock		Common Dolphin		Risso's Dolphin, Atlantic		Risso's Dolphin, Gmex		Pilot Whale, Unidentified & Long-finned, Atlantic		Short-finned Pilot Whale, Atlantic		Beaked Whale, Unidentified	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
2018	0	0	17.3	0.73	1.44	1	0.2	0.94	0	0	0.4	0.93	102	0.39	0	0
2019	12.9	1	0	0	0	0	0	0	0	0	0.4	1	131	0.37	0.3	1
2020	1	1	10.2	0.73	0	0	12.2	0.71	0	0	5.7	0.44	371	0.45	0	0

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Pelagic Drift Gillnet

	White-sided Dolphin		Common Dolphin		Risso's Dolphin, Atlantic		Pilot Whale, Unidentified		Long-finned Pilot Whale		Bottlenose Dolphin, Atlantic Offshore Stock		Beaked Whale, Unidentified		Sowerby's Beaked Whales		Harbor Porpoise	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1989	4.4	0.71	0	0	87	0.52	0	0	0	0	72	0.18	60	0.21	0	0	0.7	7
1990	6.8	0.71	0	0	144	0.46	0	0	0	0	115	0.18	76	0.26	0	0	1.7	2.65
1991	0.9	0.71	223	0.12	21	0.55	30	0.26	0	0	26	0.15	13	0.21	0	0	0.7	1
1992	0.8	0.71	227	0.09	31	0.27	33	0.16	0	0	28	0.1	9.7	0.24	0	0	0.4	1
1993	2.7	0.17	238	0.08	14	0.42	31	0.19	0	0	22	0.13	12	0.16	0	0	1.5	0.34
1994	0	0.71	163	0.02	1.5	0.16	20	0.06	0	0	14	0.04	0	0	3	0.09	0	0
1995	0	0	83	0	6	0	9.1	0	0	0	5	0	3	0	6	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	2	0.25	9	0.12	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	9	0	0	0	0	0	3	0	7	0	2	0	0	0
1999	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0

Note: This table only includes observed bycatch.

Pelagic Pair Trawl

	White-sided Dolphin		Common Dolphin		Risso's Dolphin, Atlantic		Pilot Whale, Unidentified		Long-finned Pilot Whale		Bottlenose Dolphin, Atlantic Offshore	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0.6	1	0	0	0	0	13	0.52
1992	0	0	0	0	4.3	0.76	0	0	0	0	73	0.49
1993	0	0	0	0	3.2	1	0	0	0	0	85	0.41
1994	0	0	0	0	0	0	2	0.49	0	0	4	0.4
1995	0	0	0	0	3.7	0.45	22	0.33	0	0	17	0.26
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0

Note: This table only includes observed bycatch.
na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Gulf of Mexico Shrimp Otter Trawl

	Atlantic Spotted Dolphin		Bottlenose Dolphin, Continental Shelf Stock		Bottlenose Dolphin, Western Coastal Stock		Bottlenose Dolphin, Northern Coastal Stock		Bottlenose Dolphin, Eastern Coastal Stock		Bottlenose Dolphin, TX BSE Stocks		Bottlenose Dolphin, LA BSE Stocks		Bottlenose Dolphin, AL/MS BSE Stocks		Bottlenose Dolphin, FL BSE Stocks	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1997	128	0.44	172	0.42	217	0.84	13	0.80	18	0.99	0	-	29	1.00	37	0.82	3	0.99
1998	146	0.44	180	0.43	148	0.80	20	0.95	23	0.99	0	-	31	0.99	37	0.83	2	0.99
1999	120	0.44	159	0.42	289	0.91	31	0.72	11	0.99	0	-	38	0.89	52	0.85	3	0.99
2000	105	0.44	156	0.43	242	0.86	15	0.72	15	0.99	0	-	21	0.86	47	0.77	8	0.99
2001	115	0.45	169	0.42	291	0.85	15	0.79	11	0.99	0	-	28	0.99	55	0.74	6	0.99
2002	128	0.44	166	0.42	223	0.80	29	0.84	12	0.99	0	-	118	0.98	69	0.84	6	0.99
2003	75	0.45	122	0.43	133	0.79	15	0.71	5	0.99	0	-	72	1.00	52	0.82	5	0.99
2004	84	0.46	132	0.43	111	0.80	14	0.88	5	0.99	0	-	77	0.90	26	0.90	2	0.99
2005	55	0.49	94	0.43	66	0.84	11	0.64	1	0.99	0	-	57	0.96	15	0.72	3	0.99
2006	49	0.44	77	0.43	105	0.89	16	0.67	6	0.99	0	-	55	0.97	17	0.64	3	0.99
2007	43	0.45	60	0.43	81	0.85	20	0.67	3	0.99	0	-	47	0.90	26	0.77	1	0.99
2008	37	0.53	46	0.44	56	0.80	22	0.77	1	0.99	0	-	61	1.00	28	0.76	1	0.99
2009	49	0.50	56	0.43	77	0.89	35	0.67	3	0.99	0	-	116	1.02	45	0.73	6	0.99
2010	44	0.42	57	0.40	57	0.83	17	0.64	3	0.99	0	-	113	1.09	58	0.64	6	0.99
2011	35	0.48	63	0.44	67	0.91	13	0.65	1	0.99	0	-	104	0.98	47	0.64	3	0.99
2012	28	0.44	49	0.37	48	0.79	12	0.68	0.6	1.01	0	-	31	0.76	12	0.80	0.2	1.01
2013	27	0.43	57	0.38	23	0.74	6.0	0.83	0.7	1.01	0	-	19	0.74	14	0.95	1.1	1.01
2014	23	0.43	58	0.40	57	0.84	8.3	0.74	1.1	0.98	0	-	40	0.94	2.8	0.66	1.2	0.98
2015	24	0.39	62	0.34	18	0.55	4.5	0.57	4.1	1.00	0.3	1.01	32	0.64	20	0.67	0.1	1.00
2016	43	0.41	70	0.33	46	0.47	7.2	0.56	8.1	1.00	1.1	1.00	53	0.63	46	0.63	1.7	1.00
2017	46	0.40	72	0.30	46	0.48	5.4	0.55	9.8	1.00	0.6	1.00	63	0.52	29	0.57	0.9	1.00
2018	36	0.40	64	0.30	33	0.47	5.6	0.55	8.7	0.98	0.1	0.99	45	0.53	35	0.62	0.2	0.98
2019	29	0.38	50	0.33	17	0.47	9.9	0.55	7.2	0.98	0.1	1.02	34	0.61	33	0.63	0.5	0.98

Note: This table only includes observed bycatch. For a complete list of marine mammal species interactions with this fishery, please see https://www.fisheries.noaa.gov/national/marine-mammal-protection/southeastern-us-atlantic-gulf-mexico-shrimp-trawl-fishery-mmpa.
na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Appendix V: Fishery Bycatch Summaries -- Part B: By Species

Harbor Porpoise

	Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Pelagic Drift Gillnet	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1990	na	na	0	0	2900	0.32	1.7	2.65
1991	na	na	0	0	2000	0.35	0.7	1
1992	na	na	0	0	1200	0.21	0.4	1
1993	na	na	0	0	1400	0.18	1.5	0.34
1994	na	na	0	0	2100	0.18		
1995	103	0.57	0	0	1400	0.27		
1996	311	0.31	0	0	1200	0.25		
1997	572	0.35	0	0	782	0.22		
1998	446	0.36	0	0	332	0.46		
1999	53	0.49	0	0	270	0.28		
2000	21	0.76	0	0	507	0.37		
2001	26	0.95	0	0	53	0.97		
2002	unk	na	0	0	444	0.37		
2003	76	1.13	*	*	592	0.33		
2004	137	0.91	0	0	654	0.36		
2005	470	0.51	7.2	0.48	630	0.23		
2006	511	0.32	6.5	0.49	514	0.31		
2007	58	1.03	5.6	0.46	395	0.37		
2008	350	0.75	5.6	0.97	666	0.48		
2009	201	0.55	0	0	591	0.23		
2010	259	0.88	0	0	387	0.27		
2011	123	0.41	5.9	0.71	273	0.2		
2012	63.41	0.83	0	0	277.3	0.59		
2013	19	1.06	7	0.98	399	0.33		
2014	22	1.03	5.5	0.86	128	0.27		
2015	60	1.16	3.7	0.49	177	0.28		
2016	23	0.64	0	0	125	0.34		
2017	9	0.95	0	0	136	0.52		
2018	0	0	0	0	92	0.23		
2019	13	0.51	10.8	0.63	195	0.22		

	Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Pelagic Drift Gillnet	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2020	16	0.63	3.6	0.63	121	0.22		

Note: This table only includes observed bycatch.

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Common Bottlenose Dolphin, Atlantic Offshore Stock

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Pelagic Drift Gillnet		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1991	na	na	na	na	91	0.97	0	0	26	0.15	0	0
1992	na	na	na	na	0	0	0	0	28	0.1	0	0
1993	na	na	na	na	0	0	0	0	22	0.13	0	0
1994	na	na	na	na	0	0	0	0	14	0.04	0	0
1995	na	na	56	1.66	0	0	0	0	5	0	0	0
1996	na	na	64	0.83	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0			0	0
1998	0	0	63	0.94	0	0	0	0			0	0
1999	0	0	0	0	0	0	0	0			0	0
2000	0	0	0	0	0	0	132	1.16			0	0
2001	0	0	na	na	0	0	0	0			0	0
2002	0	0	0	0	0	0	0	0			0	0
2003	0	0	0	0	0	0	0	0			0	0
2004	0	0	0	0	0	0	1[a]	na			0	0
2005	0	0	1[a]	na	0	0	0	0			0	0
2006	0	0	0	0	0	0	0	0			0	0
2007	11	0.42	0	0	48	0.95	0	0			0	0
2008	16	0.36	0	0	19	0.88	0	0			0	0
2009	21	0.45	0	0	18	0.92	0	0			8.8	1
2010	20	0.34	0	0	4	0.53	0	0			0	0
2011	34	0.31	0	0	10	0.84	0	0			0	0
2012	16	1	0	0	0	0	0	0			61.8	0.68
2013	0	0	0	0	0	0	26	0.95			0	0
2014	25	0.66	0	0	0	0	0	0			0	0
2015	0	0	0	0	18.6	0.65	0	0			0	0
2016	7.3	0.93	0	0	33.5	0.89	0	0			0	0
2017	22.1	0.66	0	0	0	0	8	0.92			0	0

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Pelagic Drift Gillnet		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2018	6.3	0.91	0	0	0	0	0	0			17.3	0.73
2019	0	0	0	0	5.6	0.92	0	0			0	0
2020	9.5	0.55	0	0	1.9	0.92	2	0.99			10.2	0.73

Note: This table only includes observed bycatch.

[a] Unextrapolated mortalities

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

White-sided Dolphin

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		Mid-Atlantic Midwater Trawl		North Atlantic Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl		Pelagic Drift Gillnet	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1990	na	na	na	na	na	na	0	0	0	0	na	na		
1991	na	na	na	na	na	na	0	0	49	0.46	na	na	0	0
1992	na	na	na	na	na	na	110	0.97	154	0.35	na	na	110	0.97
1993	na	na	na	na	na	na	0	0	205	0.31	na	na	0	0
1994	na	na	0	0	na	na	182	0.71	240	0.51	na	na	182	0.71
1995	na	na	0	0	na	na	0	0	80	1.16	na	na	0	0
1996	na	na	0	0	na	na	0	0	114	0.61	na	na		
1997	161	1.58	45	0.82	na	na	0	0	140	0.61	na	na		
1998	0	0	0	0	na	na	0	0	34	0.92	na	na		
1999	0	0	0	0	0	0	0	0	69	0.7	0	0		
2000	27	0.17	0	0	0	0	137	0.34	26	1	0	0		
2001	27	0.19	0	0	unk	na	161	0.34	26	1	unk	na		
2002	25	0.17	0	0	unk	na	70	0.32	30	0.74	unk	na		
2003	31	0.25	0	0	0	0	216	0.27	31	0.93	22	0.97		
2004	26	0.2	0	0	22	0.99	200	0.3	7	0.98	0	0		
2005	38	0.29	0	0	58	1.02	213	0.28	59	0.49	9.4	1.03		
2006	3	0.53	0	0	29	0.74	40	0.5	41	0.71	0	0		
2007	2	1.03	0	0	12	0.98	29	0.66	0	0	0	0		
2008	0	0	0	0	15	0.73	13	0.57	81	0.57	0	0		
2009	0	0	0	0	4	0.92	171	0.28	0	0	0	0		
2010	0	0	0	0	0	0	37	0.32	66	0.9	0	0		
2011	0	0	0	0	0	0	141	0.24	18	0.43	0	0		
2012	0	0	0	0	0	0	27	0.47	9	0.92	0	0		
2013	0	0	0	0	0	0	33	0.31	4	1.03	0	0		
2014	9.7	0.94	0	0	0	0	16	0.50	10	0.66	0	0		
2015	0	0	0	0	0	0	15	0.52	0	0	0	0		
2016	0	0	0	0	0	0	28	0.46	0	0	0	0		

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		Mid-Atlantic Midwater Trawl		North Atlantic Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl		Pelagic Drift Gillnet	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2017	0	0	0	0	0	0	15	0.64	0	0	0	0		
2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	79	0.28	0	0	0	0	0	0
2020	0	0	0	0	0	0	31	0.26	2	na	0	0		

Note: This table only includes observed bycatch.

na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Risso's Dolphin, Western North Atlantic Stock

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1996	0	0	0	0	0	0	0	0	99	1
1997	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	57	1
1999	0	0	0	0	0	0	0	0	22	1
2000	0	0	0	0	0	0	15	1.06	64	1
2001	0	0	0	0	0	0	0	0	69	0.57
2002	0	0	0	0	0	0	0	0	28	0.86
2003	0	0	0	0	0	0	0	0	40	0.63
2004	0	0	0	0	0	0	0	0	28	0.72
2005	0	0	0	0	0	0	15	0.93	3	1
2006	0	0	0	0	0	0	0	0	0	0
2007	33	0.34	34	0.73	3	0.52	0	0	9	0.65
2008	39	0.69	0	0	2	0.56	0	0	16.8	0.732
2009	23	0.5	0	0	3	0.53	0	0	11.8	0.711
2010	54	0.74	0	0	2	0.55	0	0	0	0
2011	62	0.56	0	0	3	0.55	0	0	11.8	0.699
2012	8	1	0	0	0	0	6	0.87	15.1	1
2013	42	0.71	0	0	0	0	23	0.97	1.9	1
2014	21	0.93	0	0	4.2	0.91	0	0	7.7	1.0
2015	40	0.63	0	0	0	0	0	0	8.4	0.71
2016	39	0.56	0	0	17	0.88	0	0	16.1	0.57
2017	31	0.51	0	0	0	0	0	0	0.2	1
2018	0	0	0	0	0	0	0	0	0.2	0.94
2019	0	0	0	0	0	0	5.3	0.7	0	0
2020	18.4	0.51	0	0	0	0	2	1.01	12.2	0.7

Note: This table only includes observed bycatch.
na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Long-finned Pilot Whale, Western North Atlantic Stock

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Midwater Trawl		North Atlantic Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2008	0	0	0	0	21	0.51	0	0	16	0.61	na	na
2009	0	0	0	0	13	0.7	0	0	0	0	na	na
2010	0	0	0	0	30	0.43	3	0.82	0	0	na	na
2011	0	0	0	0	55	0.18	0	0	1	0	na	na
2012	0	0	0	0	33	0.32	0	0	1	0	na	na
2013	0	0	0	0	16	0.42	0	0	3	0	na	na
2014	0	0	0	0	32	0.44	0	0	4	na	9.6	0.43
2015	0	0	0	0	0	0	0	0	0	na	2.2	0.49
2016	0	0	0	0	29	0.58	0	0	3	na	1.1	0.6
2017	0	0	0	0	0	0	0	0	0	na	3.3	0.98
2018	0	0	0	0	0	0	0	0	0	0	0.4	0.93
2019	0	0	0	0	5.4	0.88	0	0	0	0	0.4	1
2020	0	0	0	0	1.8	0.88	0	0	0	0	5.7	0.44

Note: This table only includes observed bycatch.
na = not applicable; unk = observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd = to be determined

Short-finned Pilot Whale, Western North Atlantic Stock

	Pelagic Longline	
Year	**M/SI (est)**	**CV**
2008	80	0.42
2009	17	0.7
2010	127	0.78
2011	305	0.29
2012	170	0.33
2013	124	0.32
2014	233	0.24
2015	200	0.24
2016	111	0.31
2017	133	0.29
2018	102	0.39
2019	131	0.37
2020	371	0.45

Note: This table only includes observed bycatch.
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Common Dolphin, Western North Atlantic Stock

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl		Pelagic Drift Gillnet		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1990	na	na	na	na	0	0	0	0	na	na			na	na
1991	na	na	na	na	0	0	0	0	na	na	223	0.12	na	na
1992	na	na	na	na	0	0	0	0	na	na	227	0.09	0	0
1993	na	na	na	na	0	0	0	0	na	na	238	0.08	0	0
1994	na	na	0	0	0	0	0	0	na	na	163	0.02	0	0
1995	na	na	7.4	0.69	142	0.77	0	0	na	na	83	0	0	0
1996	na	na	43	0.79	0	0	63	1.39	na	na			0	0
1997	0	0	0	0	93	1.06	0	0	na	na			0	0
1998	0	0	0	0	0	0	0	0	na	na			0	0
1999	0	0	0	0	0	0	146	0.97	0	0			0	0
2000	0	0	0	0	27	0.29	0	0	0	0			0	0
2001	103	0.27	0	0	30	0.3	0	0	0	0			0	0
2002	87	0.27	0	0	26	0.29	0	0	0	0			0	0
2003	99	0.28	0	0	26	0.29	0	0	0	0			0	0
2004	159	0.3	0	0	26	0.29	0	0	0	0			0	0
2005	141	0.29	0	0	32	0.28	5	0.8	0	0			0	0
2006	131	0.28	0	0	25	0.28	20	1.05	0	0			0	0
2007	66	0.27	0	0	24	0.28	11	0.94	0	0			0	0
2008	23	1	0	0	6	0.99	34	0.77	0	0			0	0
2009	167	0.46	0	0	24	0.6	43	0.77	0	0			8.8	1
2010	21	0.96	30	0.48	114	0.32	42	0.81	1[a]	na			0	0
2011	271	0.25	29	0.53	72	0.37	64	0.71	0	0			0	0
2012	323	0.26	15	0.93	40	0.54	95	0.4	1[a]	0			61.8	.68
2013	269	0.29	62	0.67	17	0.54	104	0.46	0	0			0	0
2014	17	0.53	17	0.86	17	0.53	111	0.47	0	0			0	0
2015	250	0.32	30	0.55	22	0.45	55	0.54	0	0			9.1	1.0
2016	177	0.33	7	0.97	16	0.46	80	0.38	0	0			0	0

	Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		North Atlantic Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl		Pelagic Drift Gillnet		Pelagic Longline	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2017	380	0.23	22	0.71	0	0	133	0.28	0	0			4.92	1
2018	205	0.54	98	0.91	28	0.54	93	0.45	0	0			1.44	1
2019	395	0.23	20	0.56	10	0.62	5	0.68	0	0			0	0
2020	333	0.14	30	0.55	13	0.43	50	0.25	0	0			0	0

Note: This table only includes observed bycatch.
[a] Unextrapolated mortalities
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Harbor Seal

	Herring Purse Seine		Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		Mid-Atlantic Midwater Trawl		Northeast Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
1990	na	na	na	na	na	na	na	na	0	0	602	0.68	na	na
1991	na	na	na	na	na	na	na	na	0	0	231	0.22	na	na
1992	na	na	na	na	na	na	na	na	0	0	373	0.23	na	na
1993	na	na	na	na	na	na	na	na	0	0	698	0.19	na	na
1994	na	na	na	na	na	na	na	na	0	0	1330	0.25	na	na
1995	na	na	na	na	0	0	na	na	0	0	1179	0.21	na	na
1996	na	na	na	na	0	0	na	na	0	0	911	0.27	na	na
1997	na	na	0	0	0	0	na	na	0	0	598	0.26	na	na
1998	na	na	0	0	11	0.77	na	na	0	0	332	0.33	na	na
1999	na	na	0	0	0	0	na	na	0	0	1446	0.34	0	0
2000	na	na	0	0	0	0	0	0	0	0	917	0.43	0	0
2001	na	na	0	0	0	0	0	0	0	0	1471	0.38	0	0
2002	na	na	0	0	0	0	0	0	0	0	787	0.32	0	0
2003	0	0	0	0	0	0	0	0	0	0	542	0.28	0	0
2004	0	0	0	0	15	0.86	0	0	0	0	792	0.34	0	0
2005	0	0	0	0	63	0.67	0	0	0	0	719	0.2	0	0
2006	na	na	0	0	26	0.98	0	0	0	0	87	0.58	0	0
2007	0	0	0	0	0	0	0	0	0	0	92	0.49	0	0
2008	0	0	0	0	88	0.74	0	0	0	0	242	0.41	0	0
2009	0	0	24	0.92	47	0.68	0	0	0	0	513	0.28	1.3	0.81
2010	0	0	11	1.1	89	0.39	1[a]	0	0	0	540	0.25	2	0
2011	1[a]	0	0	0	21	0.67	0	0	9	0.58	343	0.19	0	0
2012	0	0	23	1	0	0	0	0	3	1	252	0.26	1	0
2013	0	0	11	0.96	0	0	0	0	4	0.89	147	0.3	0	0
2014	0	0	10	0.95	19	1.06	0	0	11	0.63	390	0.39	na	ma
2015	0	0	7.4	1.0	48	0.52	0	0	0	0	474	0.17	2[a]	na
2016	0	0	0	0	18	0.95	0	0	0	0	245	0.29	1[a]	na

	Herring Purse Seine		Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		Mid-Atlantic Midwater Trawl		Northeast Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl	
Year	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**	**M/SI (est)**	**CV**
2017	0	0	0	0	3	0.62	0	0	0	0	298	0.18	0	0
2018	0	0	6	0.94	26	0.52	0	0	0	0	188	0.36	0	0
2019	0	0	7	0.93	17	0.35	0	0	5.4	0.88	316	0.15	0	0
2020	0	0	4.3	0.67	9	0.43	0	0	4.6	0.68	261	0.14	0	0

Note: This table only includes observed bycatch.
[a] Unextrapolated mortalities
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Gray Seal

	Herring Purse Seine		Mid-Atlantic Bottom Trawl		Mid-Atlantic Gillnet		Mid-Atlantic Midwater Trawl		Northeast Bottom Trawl		NE Sink Gillnet		Northeast Midwater Trawl	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1994	na	na	na	na	0	0	0	0	0	0	19	0.95	0	0
1995	na	na	na	na	0	0	0	0	0	0	117	0.42	0	0
1996	na	na	na	na	0	0	0	0	0	0	49	0.49	0	0
1997	na	na	0	0	0	0	0	0	0	0	131	0.5	0	0
1998	na	na	0	0	0	0	0	0	0	0	61	0.98	0	0
1999	na	na	0	0	0	0	0	0	0	0	155	0.51	0	0
2000	na	na	0	0	0	0	0	0	0	0	193	0.55	0	0
2001	na	na	0	0	0	0	0	0	0	0	117	0.59	0	0
2002	na	na	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	242	0.47	0	0
2004	0	0	0	0	69	0.92	0	0	0	0	504	0.34	0	0
2005	0	0	0	0	0	0	0	0	unk	unk	574	0.44	0	0
2006	na	na	0	0	0	0	0	0	0	0	248	0.47	0	0
2007	0	0	0	0	0	0	0	0	unk	unk	886	0.24	0	0
2008	0	0	0	0	0	0	0	0	16	0.52	618	0.23	0	0
2009	0	0	38	0.7	0	0	0	0	22	0.46	1063	0.26	0	0
2010	0	0	0	0	267	0.75	1[a]	0	30	0.34	1155	0.28	0	0
2011	0	0	25	0.57	19	0.6	0	0	58	0.25	1491	0.22	0	0
2012	0	0	30	1.1	14	0.98	0	0	37	0.49	542	0.19	1[a]	na
2013	0	0	29	0.67	0	0	0	0	20	0.37	1127	0.2	1[a]	na
2014	0	0	7	0.96	22	1.09	0	0	19	0.45	917	0.14	0	0
2015	0	0	0	0	15	1.04	0	0	23	0.46	1021	0.25	0	0
2016	0	0	26	0.57	7	0.93	0	0	0	0	498	0.33	0	0
2017	0	0	26	0.40	22	1.09	0	0	16	0.24	930	0.16	0	0
2018	0	0	56	0.58	15	1.04	0	0	32	0.42	1113	0.32	1[a]	na
2019	0	0	22	0.53	7	0.93	0	0	30	0.37	2014	0.17	0	0
2020	0	0	34.7	.35	9.3	0.72	0	0	25.8	0.26	1357	0.14	0	0

Note: This table only includes observed bycatch.
[a] Unextrapolated mortalities
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Harp Seal

	Mid-Atlantic Gillnet		Northeast Bottom Trawl		NE Sink Gillnet	
Year	**M/SI**	**CV**	**M/SI**	**CV**	**M/SI**	**CV**
1994	0	0	0	0	861	0.58
1995	0	0	0	0	694	0.27
1996	0	0	0	0	89	0.55
1997	0	0	0	0	269	0.5
1998	17	1.02	0	0	78	0.48
1999	0	0	0	0	81	0.78
2000	0	0	0	0	24	1.57
2001	0	0	49	1.1	26	1.04
2002	0	0	0	0	0	0
2003	0	0	*	*	0	0
2004	0	0	0	0	303	0.3
2005	0	0	0	0	35	0.68
2006	0	0	0	0	65	0.66
2007	38	0.9	0	0	119	0.35
2008	176	0.74	0	0	238	0.38
2009	0	0	5	1.02	415	0.27
2010	0	0	0	0	253	0.61
2011	0	0	3	1.02	14	0.46
2012	0	0	0	0	0	0
2013	0	0	0	0	22	0.75
2014	0	0	0	0	57	0.42
2015	0	0	0	0	119	0.34
2016	0	0	0	0	85	0.50
2017	0	0	0	0	44	0.37
2018	0	0	0	0	14	0.80
2019	29	0.84	5.4	0.89	163	0.19
2020	2	1.01	1.8	0.89	72	0.22

Note: This table only includes observed bycatch.
na=not applicable; unk= observer coverage was absent or too low to detect bycatch, or no estimate generated; tbd= to be determined

Appendix VI: Table C. Estimates of Human-caused Mortality Resulting from the *Deepwater Horizon* Oil Spill

Estimates of human-caused mortality are a result of a population model developed to estimate the injury and time to recovery for stocks affected by the *Deepwater Horizon* (DWH) oil spill, taking into account long-term impacts resulting from mortality, reproductive failure, reduced survival rates, and the proportion of the stock exposed to DWH oil (DWH MMIQT 2015).

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Beaked Whales[a]	15.96	13.49	11.42	9.68	8.21	6.28	4.81	3.68	2.79	2.09	1.52	1.05	0.65	0.31	0
Common Bottlenose Dolphin, Oceanic Stock	96.55	81.93	69.71	59.39	50.63	38.86	29.86	22.88	17.40	13.03	9.48	6.54	4.06	1.91	0
Rice's Whale	1.44	1.22	1.03	0.88	0.74	0.57	0.44	0.33	0.25	0.19	0.14	0.09	0.06	0.03	0
Clymene Dolphin	26.23	22.12	18.71	15.86	13.45	10.28	7.86	6.00	4.55	3.40	2.46	1.70	1.05	0.49	0
False Killer Whale	6.67	5.64	4.78	4.05	3.44	2.63	2.01	1.54	1.17	0.87	0.63	0.44	0.27	0.13	0
***Kogia* spp.**	111.92	91.48	75.08	61.80	50.98	37.92	28.27	21.04	15.56	11.33	8.03	5.40	3.27	1.50	0
Melon-headed Whale	29.33	24.83	21.04	17.84	15.13	11.56	8.85	6.76	5.13	3.83	2.78	1.92	1.19	0.56	0
Pantropical Spotted Dolphin	748.73	631.49	534.21	452.68	384.00	293.38	224.47	171.38	129.89	96.96	70.37	48.47	30.04	14.12	0
Pygmy Killer Whale	4.94	4.19	3.56	3.03	2.57	1.97	1.51	1.16	0.88	0.66	0.48	0.33	0.21	0.10	0
Risso's Dolphin	16.18	13.73	11.68	9.95	8.48	6.51	5.00	3.83	2.92	2.18	1.59	1.10	0.68	0.32	0
Rough-toothed Dolphin	113.72	96.50	82.11	69.96	59.64	45.78	35.18	26.96	20.50	15.35	11.17	7.72	4.79	2.26	0
Shelf Dolphins[b]	912.14	774.01	658.54	561.05	478.31	367.12	282.07	216.17	164.39	123.07	89.55	61.82	38.38	18.07	0
Short-finned Pilot Whale	10.79	9.13	7.73	6.56	5.56	4.25	3.25	2.49	1.88	1.41	1.02	0.71	0.44	0.21	0
Sperm Whale	29.82	25.12	21.20	17.90	15.14	11.53	8.79	6.70	5.07	3.78	2.74	1.89	1.17	0.55	0
Spinner Dolphin	352.31	297.15	251.37	213.01	180.70	138.05	105.63	80.65	61.13	45.63	33.12	22.82	14.14	6.65	0
Striped Dolphin	39.30	33.15	28.04	23.76	20.16	15.40	11.78	9.00	6.82	5.09	3.69	2.54	1.58	0.74	0

a. Beaked whales include Blainville's beaked whales, Gervais' beaked whales, and Cuvier's beaked whales
b. Shelf dolphins include common bottlenose dolphins and Atlantic spotted dolphins

DWH MMIQT [*Deepwater Horizon* Marine Mammal Injury Quantification Team]. 2015. Models and analyses for the quantification of injury to Gulf of Mexico cetaceans from the *Deepwater Horizon* Oil Spill, MM_TR.01_Schwacke_Quantification.of.Injury.to.GOM.Cetaceans. Southeast Fisheries Science Center, Protected Resources and Biodiversity Division, 75 Virginia Beach Dr., Miami, Florida 33140. PRBD Contribution #: PRBD-2020-02.