From: Alice Abellanida
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Biopesticide Mosquitos
Date: Sunday, March 5, 2023 10:40:14 AM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Alice Abellanida
Oahu

From: Connie Arthur
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Item C-2
Date: Wednesday, March 8, 2023 3:19:15 PM

Hi there,

My name is Constance Arthur, and I am a resident of Hawaii, I live with my husband in Waikoloa.

I am writing today in support of Wolbachia program for mosquitoes, to reduce the mosquito population in Hawaii. We NEED this!!

Hawaii can NOT afford to lose more bird species which are incredibly vulnerable to Avian malaria whose vector is mosquitoes.

PLEASE allow this program to go into effect, we all thank you for it!

Constance Arthur
808-895-1083

From: Kyhl Austin
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Tuesday, March 7, 2023 2:50:22 PM

Dear Chair Designate Chang & members of the Board of Land and Natural Resources,

I am an entomology Ph.D. student at the University of Hawai‘i at Mānoa writing today to express my **SUPPORT** for **Agenda Item C-2** which proposes two actions:

1) the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui and
2) the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild.

Extinction is forever.

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction **forever**. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

I believe the proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

Mosquitoes don't belong in Hawai‘i. Native forest birds do.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Kyhl A. Austin

University of Hawai‘i at Mānoa
Ph.D. Student, Rubinoff Lab
University of Hawai‘i Insect Museum

Gilmore Hall 607A

--
Kyhl A. Austin
University of Hawai‘i at Mānoa
Ph.D. Student, Rubinoff Lab
Gilmore Hall 607
3050 Maile Way
Honolulu, HI 96822-2271

ISLAND CONSERVATION

Preventing Extinctions

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

Island Conservation is a globally focused, US registered 501(c)3 non- profit organization with a mission to prevent extinctions by removing invasive species from islands. Islands are special places to wildlife and people. They represent only a small percentage of the earth's land mass but house a disproportionate amount of biodiversity with 20% of all bird, reptile, and plant species. Moreover, they are home to about 11% of the people in the world and safeguard invaluable cultural resources. Unfortunately, they also are epicenters of species loss with 80% of recorded extinctions. Rodents (rats and mice) are the most widespread invasive species on islands having been introduced to ~90% of the islands of the world. They cause serious damage to native island ecosystems and have been identified as the main cause of countless species' extinctions. Islands are currently home to 40% of all IUCN Endangered and Critically Endangered species, and if left unmanaged, invasive rodents will continue to cause extinction.

In Hawai'i, the extinction crisis is accelerated, in particular for forest birds. Hawaiian honeycreepers are found no where else in the world and were once in great number and diversity in Hawai'i. Only 17 of the 50 species of honeycreepers are left. Without urgent action, several more will be lost in the next 10 years due to avian malaria.

Avian malaria is transmitted to honeycreepers by introduced mosquitoes and it has devastated their populations limiting their presence to upslope refugia. With climate change, mosquitoes are reaching higher elevations on the mountains due to warmer temperatures. With them, avian malaria is spreading to the last remannents of some species of honeycreepers.

In face of the risk of irreversible loss, the best available tools should be utilized. The Incompatible Insect Technique is innovative but proven effective and safe elsewhere. It can supress mosquito populations and save Hawai'i's native forest birds.

Therefore, Island Conservation **SUPPORTS, Agenda Item C-2** on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui and urge you to support it as well.

Sincerely,

PCBaiao

Patty Baiao
Director of Partnerships
Island Conservation

From: Melissa Barker
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C-2, use of Wolbachia Incompatible Insect Technique
Date: Monday, March 6, 2023 9:57:06 AM

Dear Chair Designate Change & Members of the Board of Land and Natural Resources,

I am writing in support of Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Maui and Kaua'i.

Please SUPPORT the mosquito control efforts touched upon in Agenda Item C-2.

Thank you for your attention and consideration.

Melissa Barker
Kapaa, HI

From: Kallie Barnes
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C-2 Testimony
Date: Tuesday, March 7, 2023 9:34:20 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

I believe our extinction crisis can and should be stopped. There are no more excuses, we must take decisive action now! In fact, we need to be doing more, but this is the most current and pressing item we have in our tool box.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
Kallie

--
Kallie Barnes
Propagation Field Technician, Three Mountain Alliance

Email: kallieb@hawaii.edu
Cell: (808)796-6753
PO Box 52
Hawai'i National Park, HI 96718

ThreeMountainAlliance.org

From: Elif Cuceloglu Beall
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony in SUPPORT, Agenda Item C-2 , use of the Wolbachia Incompatible Insect Technique
Date: Tuesday, March 7, 2023 4:38:33 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources:

I SUPPORT, Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

Our extinction crisis is imminent, and action to protect our already incredibly endangered and unique Hawai`i Birds is important now before they are lost forever. Every hole in the web of the ecosystem causes the entire ecosystem to weaken.

I believe the proposed conservation actions are environmentally responsible and reasonable.

Please SUPPORT the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
Elif Beall

From:	kara bernarda
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Wednesday, March 8, 2023 2:51:28 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

From: Laura Berthold
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony for Friday, March 10th
Date: Sunday, March 5, 2023 7:32:17 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

I am a conservation biologist on Maui and have been working with these forest birds for the last 14 years. The protection of these birds is important for the native ecosystem, Hawaiian culture, and for biodiversity.

The circumstances are dire and swift action is needed. Avian malaria, a disease transmitted by invasive southern house mosquitoes, is driving the extinction of our forest birds. Due to climate change mosquitoes and malaria are being found higher and higher in elevation. I am seeing this first hand from my experience with working with these birds in the wild. The changes of where I used to see and hear these birds. Certain parts of the forest have become quiet. I have literally watched individual birds die from this disease.

Without mosquito control, several species of honeycreepers will become extinct in the next ten years. The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds.

Please SUPPORT the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
Laura Berthold
803 Olowalu Village Road, Lahaina, HI 96761

From: Estelle C
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Opposed
Date: Tuesday, March 7, 2023 6:08:22 PM

Please do not do this!

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Thank you!

Mahalo,
Estelle Birch

TESTIMONY IN SUPPORT OF AGENDA ITEM C-2
FOR THE MEETING OF THE
BOARD OF LAND AND NATURAL RESOURCES
DATE: March 10, 2023
TIME: 9:15 A.M.
LOCATION: 151 Punchbowl St. Room 132
Kalanimoku Building

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauai and Maui.

The health of our manu (bird) population is crucial to the overall health and well-being of our kanahele (forest); of our ʻāina (land); of our islands; or our honua (world) ; of our kanaka (people). The manu population is a key part of our native ecosystem. I believe the extinction crisis is a natural disaster that needs to be addressed now. The proposed conservation actions are necessary, and taking these steps moves us in the right direction. We know initiating mosquito control efforts is tremendously important.

Again, I fully support the Department of Land and Natural Resources' strategy to respond to the bird extinction crisis on Kauai and Maui as contained in the agenda item C-2.

Mahalo nui!

Toni Bissen
Executive Director Pūʻā Foundation
P.O. Box 11025, Honolulu, Hawaii 96828
Ph: 808-945-3570; Email: info@puafoundation.net

From:	Eric B
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Subject: OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Tuesday, March 7, 2023 7:43:23 PM

Aloha,

I'm strongly opposed to this project, it is an experiment that could have significant secondary impacts on the birds, humans and environment.

I do not accept the Environmental Assessment's (EA) Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand a full scope Environmental Impact Statement (EIS).

Who will take responsibility if something goes wrong – the federal government, the State of Hawaii, steering committee partners, private landowners? **Adequate studies and research have not been conducted**.

Public testimony has shown overwhelming opposition to these mosquito releases. The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

Conflicts of interest have not been disclosed or addressed. Per HRS §171-4 (d), BLNR Chair Dawn N.S. Chang and Board Member Vernon Char must recuse themselves from participating in any discussion or voting in this matter, given that they have clear conflicts of interest:

> HRS §171-4 (d) Each member shall disclose and file with the board a list of all transactions with the department of land and natural resources in which the member has a direct interest. The member shall also disclose all transactions with the department involving any corporation, association, partnership, or joint venture in which the member is an officer, partner, or employee. Any member having any interest, direct or indirect, in any matter before the board shall disqualify oneself from voting on or participating in the discussion of the matter.

Mahalo,

Eric Bjerke
Honoka'a, HI

From: Laurel Brier
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Proposed plans for protecting/saving endangered bird species
Date: Wednesday, March 8, 2023 4:21:26 PM

Thank you for the opportunity to provide testimony on this important issue of addressing the extinction crisis of our native forest birds.
I attended two of the webinars from HISAM explaining the proposed plans for habitat protection through mosquito control and raising akikiki and kiwikiu. These measures are rather radical, but I believe they are well researched and needed at this time to try and protect and preserve our native birds. As a Kauai resident, cabin leaser in Koke'e, and climate activist I have a vested interest.

Sincerely,
Laurel Brier

From: Brittni Brooks
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Hawaii Forest Bird Extinction
Date: Tuesday, March 7, 2023 3:37:45 PM

Aloha,

I am writing this email in regards to the forest bird extinction crisis in Hawai'i. I adamantly support all measures to be taken to save these birds. I hate to imagine Hawai'i without native birds. I support habitat protection through mosquito control using the Incompatible Insect Technique and securing critically endangered 'akikiki, 'akohekohe, and kiwikiu. These birds are disappearing and if action isn't taken in the next few years, they will be gone forever.

Please take necessary actions to restore native habitat and protect the birds from cats, pigs, and rodents. Avian malaria is one of the major threats. If this is not addressed, the birds will be gone.

Thank you for your consideration.

Brittni Brooks

From: Michael Brownstein
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date: Wednesday, March 8, 2023 6:05:06 AM

Dear BLNR,

I have lived on Maui and will do so again.

Please know I am opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown. Sound science and common sense dictate that the precautionary priniciple must be followed before taking this action.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Sincerely,

Michael Brownstein

From: Sammie Buechner
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL]
Date: Wednesday, March 8, 2023 8:44:32 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

> the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
> the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

I spent 5 years working in Hawaii towards protecting the native flora and fauna, and I have seen first-hand the devastation caused by mosquito-borne diseases. We do not have 5-10 years to kick this can down the road. The can has already been kicked to a dead end and bounced against the wall 57 times. This is the only action that has any hope of preventing the imminent extinction of multiple species. These species cannot be found anywhere else in the world, and once they are gone, we cannot get them back.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Sammie Buechner
--
Sammie Buechner
USGS—Pacific Island Ecosystem Research Center

C: (608) 695-9004

From:	Nicole Busto
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Saturday, March 4, 2023 7:32:36 PM

To Whom it May Concern,

I'm strongly opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

I demand an Environmental Impact Statement (EIS).

There needs to be awareness of the massive possibility of this going terribly wrong with lasting unintended consequences.

Stop playing God!!!

Regards,
Nicole LeClaire

Maui Nutritional Therapy
Nicole LeClaire NTP, CGP
808-463-7783

From: Allison Cabrera
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] support of agenda item C-2
Date: Tuesday, March 7, 2023 10:34:02 AM

I am submitting testimony in strong support of agenda item C-2.

Our native Honeycreepers are foundational to the culture, forests, and ecosystems of Hawai'i. On the island of Kaua'i, we have already lost dozens of forest bird species due to avian diseases transmitted by non-native mosquitoes, among them iconic species like the Kaua'i ʻō'ō, featured in mahiole and ʻahu ʻula, and the spectacular Kaua'i ʻakialoa, a pollinator of ʻōhi'a lehua and insect eater. We are grieving the loss of their song, the loss of their beauty and the loss of their presence.
Of the six remaining Honeycreepers species on Kaua'i today, two are critically endangered. The 'akikiki is going extinct in the wild as you are reading these lines and the ʻakeke'e is predicted to go extinct in the wild within the next couple years. As pollinators, seed dispersers, and insect eaters, they are essential for our forests and without action or delayed action, these species have no chance of survival.
The incompatible insect technique or mosquito birth control provides us with a glimmer of hope and opportunity to save the last remaining Honeycreepers from extinction. This method has been used successfully worldwide for vector control for human diseases and gives us a powerful tool to address the main cause for the decline of our Honeycreepers: avian malaria transmitted by the Southern House Mosquito. Neither the disease nor the vector is native to the Hawaiian islands and the mosquitoes have invaded the highest elevation of our island, decimating our Honeycreeper populations every day. Our forest birds evolved in a mosquito-free Hawai'i and a single bite of an infected mosquito can be enough to kill an ʻi'iwi.
The question to consider for our forests and for our ecosystem: How many more native forest bird species can we afford to lose, before the environmental impact will lead to the collapse of our native Hawaiian forests and watersheds?

Thank you,
Allison Cabrera

From: Sherri Carden
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] mosquito release
Date: Wednesday, March 8, 2023 6:33:38 AM

I am firmly opposed to releasing mosquitos!

Sherri Carden
(808) 990-6838

From: Mike"s Gmail
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Wolbachia program
Date: Wednesday, March 8, 2023 4:13:47 PM

Please support the Wolbachia program to give our native birds a chance of not becoming extinct.
This program is one of the last great potentials of saving our native birds.
Along with predator control, the native birds may stand a fighting chance to remain part of Hawaii.
Mahalo Nui Loa
Michael P Carion

Sent from my iPhone

From: Ru carley
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Mosquito Release
Date: Wednesday, March 8, 2023 7:09:02 AM

I *DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan* ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement(EIS).***

Sent from my iPhone

From: Dave Carrothers
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] C.2
Date: Saturday, March 4, 2023 2:30:39 PM

I encourage the board to recommend the methods outlined by DLNR-DOFAW to aggressively treat mosquitoes to save our native birds. We can't afford to wait any longer as every day another native bird is closer to extinction. Mahalo

Sent from Mail for Windows

From:	Yvonne Chan
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date:	Wednesday, March 8, 2023 1:33:07 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever.

I have personally witnessed the extinction of the Po‘ouli. Our forests and our children are forever robbed of the presence of this magnificent bird, and all the other native hawaiian birds that have gone extinct.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Yvonne Chan

--
Yvonne Chan, PhD (she/her)
Director of Community Science

‘Iolani School
563 Kamoku Street
Honolulu, HI 96826
(808) 943-2369
Office Hours Zoom

From: Ryan Chang
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian Honeycreepers
Date: Tuesday, March 7, 2023 4:14:18 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Recently I went to try to look for the kiwikiu and ‘akohekohe on the island of Maui. After spending a whole day, listening and looking we couldn‘t see or find any. Back in 2013 on the island of Kaua'i I was lucky enough to see ‘I‘iwi on my hike through the 'Alaka'i swamp. Fast forward to 2022 of November, there isn't even a call of an ‘I‘iwi that I heard. It is troubling to me that these species are disappearing within my lifetime. I urge you to move quickly with whatever steps are needed to put into place the use of the IIT. This technique will buy these birds some time so that we can figure out some permanent measures we need to take in the future. We cannot let our birds go extinct!
Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Ryan Chang

From: Aryana Channe
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Submitting Testimony on Agenda Item C2
Date: Tuesday, March 7, 2023 12:33:22 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. **There are serious risks, and the outcome is admittedly unknown.**

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Respectfully,

Aryana Channe

From: Deva Chappell
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Comment: I"m opposed to the mosquito release plan
Date: Saturday, March 4, 2023 4:36:48 PM

ATTN: for BLNR Meeting 3/10/23 9:15am Agenda Item C2:
"Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I am opposed to the planned biopesticide mosquito releases on Maui, and want an Environmental Impact Statement. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS). I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

Aloha!

Dale Chappell

aka Deva
Kokomo rd, Hai'ku, Maui

From: Saxony Charlot
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 5:30:11 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Hawai'i is the extinction capital of the world, and unfortunately bird extinctions in Hawai'i outnumber any other location in the last 700 years. Mosquitoes today are one of the most urgent threats to our native forest manu and effective mosquito suppression methods, such as Wolbachia IIT, are crucial in protecting what forest birds Hawai'i has left. Forest birds are not only vital in protecting our native forests, but also incredibly important to Hawaiian culture and their losses are felt deeply.

Ensuring that the most endangered of our remaining honeycreepers have population support through breeding centers until they can be introduced back into the wild is important in their continued protection and extinction mitigation.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2. Please help prevent more losses to Hawai'i's unique ecology, which has suffered countless past extinctions.

Mahalo nui for the opportunity to provide testimony,
Saxony Charlot

From:	Chuck Chimera
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Written Testimony in Support of the proposed use of the Wolbachia Incompatible Insect Technique (Discussed in Agenda Item C-2)
Date:	Tuesday, March 7, 2023 9:27:14 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I am submitting testimony in support of Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

Over the course of my career as a botanist in the islands, I've had the privilege of working in some amazing, and remote places set aside to protect Hawaii's rare plants and animals, and despite being a "plant guy" have fallen in love with charismatic, and breathtakingly beautiful forest birds like the scarlet-vermillion 'i'iwi, the 'ākohekohe, the kiwikiu, and so many more. In spite of the best efforts and dedication of my colleagues in conservation, rare forest birds like the 'i'iwi continue to decline in numbers, even in their remote mountain habitats, largely due to diseases carried by mosquitoes, and the effects of climate change that allow mosquitoes to survive at higher elevations.

The thought of I, or my 10-year old son, never getting to see, or hear 'i'iwi and other forest birds again, has almost left me without hope, until I learned of the Wolbachia Incompatible Insect Technique to release male mosquitoes to reduce the number of these disease-carrying insects in our forests. I have read that this technique is already being used around the world to protect humans from diseases like dengue and the Zika virus and could save many of our remaining endangered forest birds from extinction. I therefore urge you to support the mosquito control efforts put forth in agenda item C-2.

Mahalo nui loa,

Chuck Chimera

Honokaa

From:	Kristina Chyn
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date:	Wednesday, March 8, 2023 1:01:36 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Kristina Chyn

--

Kristina Chyn, PhD

(she/her)

Deputy Project Lead | Wildlife Refuge Manager

Oahu/Maui National Wildlife Refuge Complex | US Fish & Wildlife Service (USFWS)

512 817 8650

- https://kristina-chyn.weebly.com/

From: George Chyz
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2
Date: Saturday, March 4, 2023 3:33:31 PM

Aloha,

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is absolutely unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Sincerely,

George W. Chyz

213 Hoolawa Rd.
Haiku, HI 96708

From: Kalena Clark
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2 - DLNR"s Proposed Strategy to Prevent Bird Extinction on Maui and Kauai
Date: Wednesday, March 8, 2023 10:15:37 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I DEMAND AN ENVIRONMENTAL IMPACT STATEMENT~

I am frankly shocked at this plan with so little publicity about it. Once this is done, it is a done deal and it must be carefully studied especially since it is not even certain it will work! Mosquitos are considered the most dangerous animal on the planet due to the diseases they carry and have we not learned from the Wuhan virus disaster?
One slipup could result in a major public health disaster!
Please do the Impact Statement!

From:	Leslee Rachel Cooper
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] re: DLNR's Proposed Strategy to prevent Birds" Extinction on Maui and Kauai
Date:	Wednesday, March 8, 2023 10:19:12 AM

RE: "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I am writing to call for an Environmental Impact Statement (EIS) on the DLNR's Proposed Strategy to prevent Birds' Extinction on Maui and KauaiI.

The following risk factors re: health and safety of birds --- as well as all aspects of 'āina and public health -- must be considered before undertaking this irreversible experiment on Maui and Kaui:

• risks of increased pathogen infection
• introduction of a different strain of *Wolbachia* bacteria, which could cause the released mosquitoes to actually become MORE capable of spreading diseases like avian malaria and West Nile virus (bird and human)
• possible risks of horizontal transmission
• significant unintended environmental effects
• undesirable evolutionary consequences
• population replacement
• accidental release of females (who bite and breed)
• negative impacts on natural viewscape
• noise from drones creating more ambient stress and causing negative health impacts on occupants both bird, human and animal
• loss of wilderness aspects of gorgeous 'āina

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

I call for an Environmental Impact Statement (EIS).

Thank you for your public service.

Mahalo!
Leslee Rachel Cooper

From: Lisa Cali Crampton
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] written testimony for C-2 at BLNR Meeting of 3/10
Date: Wednesday, March 8, 2023 4:14:09 PM

Aloha Board Members,

I am submitting testimony for item C-2, addressing the extinction crisis facing our native honeycreepers and in support of DLNR's proposed strategy for addressing it.

I have led forest bird research and conservation on Kaua'i since 2010. There are six honeycreeper species - four endemic - on Kaua'i, an endemic thrush (puaiohi) and an endemic 'elepaio. The year I started, the endemic honeycreepers 'akikiki and 'akeke'e joined the puaiohi on the endangered species list.

Yet, when I first arrived here, you could still see the 'akikiki, 'akeke'e, and puaiohi along the Pihea Trail near Koke'e. Now you are lucky to see an 'anianiau or an 'apapane on these trails on any given day. The endangered species have retreated.

When I first arrived here, we could watch 'akikiki and 'akeke'e feeding their chicks while we ate breakfast at our field camp at Halehaha, and we were awoken each morning by the fluting song of the puaiohi. Now there are no more 'akikiki left at Halehaha and even the other birds are scarce. Our forests are so quiet, it's spooky.

Our data have documented the declines of all the Kaua'i forest bird species across the island and the extirpation of 'akikiki at Halehaha. Simultaneously our surveys have registered the inexorable advances of the southern house mosquito and the deadly disease it carries, avian malaria, into Koke'e State Park and the Alaka'i Plateau, triggering these declines. Most honeycreeper species are highly susceptible to avian malaria and die quickly after being bitten by an infected mosquito. However, until the early 2000s, it was too cold most of the year for mosquitoes and malaria to persist in these high elevation areas. Climate change has changed all that; it has warmed the Plateau and affected our rain and stream flows, such that now mosquitoes can breed up there year round, transmitting the disease year round.

In 2020, we experienced our first "mosquito storm" at Halehaha, hundreds of mosquitoes at night at a camp where formerly we slept without mosquito netting or mosquito spray. That year the 'akikiki crashed from 13 pairs at that site to only two pairs.

Our data suggest that the 'akikiki will go extinct in the wild due to avian malaria this year. Instead, we plan to collect as many of the 40 remaining 'akikiki as possible and remove them to safety from mosquitoes in the Maui facilities managed by San Diego Zoo Wildlife Alliance. Our crews are in the field finding these last 'akikiki as I write.

Our data suggest that there are 650 'akeke'e left in the wild, compared to the several thousand 'akeke'e thought to inhabit the Plateau in 2010. Since it is more numerous, we think this species will persist in the wild until at least 2025, when it may go extinct. We also know it does not do that well in captivity so we plan for now to leave it in the wild on Kaua'i.

For this species, and the other more common honeycreepers on Kaua'i and throughout Hawai'i, the best tool we have to prevent their extinction is landscape-level mosquito control achieved

through the Incompatible Insect Technique, IIT. This safe and effective tool, used globally to control human mosquito-borne diseases like Zika and Dengue, will suppress mosquito populations in forest bird habitat on Maui and Kaua'i, interrupting the disease transmission cycle and improving forest bird survival. It will allow populations of 'akeke'e to grow in number and expand their range, and create a safe habitat on Kaua'i to which we can return the 'akikiki that we will have been holding in human care, allowing them to also recover in the wild.

This tool will give Hawaii's honeycreepers a fighting chance to not only recover but once again flourish, allowing also our forests to flourish. These species are responsible for the well-being of the forest, providing services like pollination and insect control. Our research shows that these services cannot be replaced by non-native species. These species are also essential to our spiritual, emotional, and cultural well-being, connecting us to the natural world, and Hawaiians believe, to the divine. And they are important economic engines, bringing tens of thousands of tourism dollars from the ever-growing "birding" hobby to our islands.

But it is more than that. Saving these species is our kuleana, our moral obligation. Extinction is not an option. I do not want to say we had a chance to save the 'akikiki and 'akeke'e, but turned away from a great option: IIT mosquito control.

The birds have been losing their voices. I urge you all to support the DLNR's plan and give them a voice again.

Mahalo for reading my testimony,

Dr. Lisa "Cali" Crampton
Project Manager
Kauai Forest Bird Recovery Project
PO Box 27 (USPS mail) or 3751 Hanapepe Rd (courier packages)
Hanapepe HI 96716
808.335.5078

From: Lisa Cali Crampton
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony on C2 on 3/10
Date: Tuesday, March 7, 2023 7:20:04 PM

Aloha,

I hope to provide video testimony on C2 on Friday but may be in meetings depending on when that item is discussed. Could you please send me the Zoom link? I will also provide written testimony in case I cannot join by Zoom.

Thanks
Lisa Crampton

Sent from my iPhone

From: Scott Crawford
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] March 10 Agenda Item C-2
Date: Saturday, March 4, 2023 2:50:52 PM

Aloha Chair Designate Chang and Board Members,

I am writing to express my strong support for Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui.

I am aware that some of our precious endemic honeycreepers, in particular the Kiwikiu, are highly endangered and under threat of imminent extinction, due to mosquito-borne avian malaria. The native birds are a crucial part of the overall forest ecosystem in the East Maui watersheds, and the health native forest is crucial for our water supply.

I have had a chance to review the method of introducing male mosquitoes bred with an incompatible Wolbachia bacteria as a means to control reproduction and reduce mosquito populations, thus giving the native birds a chance to not only survive but to recover and thrive again.

While we know the consequences of inaction are the loss of these native bird species, this appears to be a very safe method of mosquito control, with little to no risk. The risk-reward equation tilts very heavily on the side of moving forward with this project. I find this project to provide great hope for the protection of our native birds and our forest ecosystems.

I understand this agenda item is just an informational briefing and that you won’t be taking action on the item at this time, but I just want to let you know that as a resident of East Maui who has worked in forest protection projects and who also works on projects like taro farms and other agricultural production that depend on the flow of water and the health of the watershed, I am very grateful for all of the researchers who have developed this technique and are bringing this project through the requires steps for approval. Time is short for our precious bird ‘ohana, so I believe that the sooner we can begin implementation, the better.

Mahalo for your consideration.

Scott Crawford
PO Box 645
Hana, HI 96713
scott@aloha.net

From: Kimberly De Souza
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] C-2 - Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai
Date: Wednesday, March 8, 2023 3:56:56 PM

Aloha kākou,

My name is Kimberly De Souza and I live in Kailua Kona on Hawai'i Island. I am writing in regards to agenda C-2 - the Hawai'i forest bird extinction crisis and I wanted to highlight how important this crisis is to address **immediately**.

Extinction is forever and we are running out of time for these birds. As you know, the native forest birds have a wide variety of factors contributing to their population decline. Avian malaria is rampant and as the climate warms, mosquitos quickly multiply, and are able to move to higher elevations, because of this the native forest bird habitats continue to shrink each year. Development has also shrunk their habitat and has allowed predators to move into their forest homes - predators such as mongoose and cats have decimated native bird populations and caused so much extinction.

Recently, I visited the Palila bird sanctuary on the Hawai'i Island. We heard a handful of Palila calls but didn't get to see any birds despite the māmane seed pods (the palilas source of food) being abundant in the forest at this time. Devastatingly, we also found at least 2 instances of cat/mongoose predation on native birds. The first instance was an 'amakihi (confirmed - please see photo attached), where we found its decapitated head and feathers all over the ground. The second instance, we couldn't identify the bird because all that was left were a trail of feathers. This is absolutely heartbreaking.

These two threats need to be addressed ASAP in order to save Hawaii's native forest birds. I am really hoping DLNR's proposed strategy will adequately address both the threat of predators such as cats and mongoose and Avian malaria transmitted by mosquitoes.

There has been so much loss of our unique native Hawaiian biodiversity on these islands. Something needs to be done soon so that we can preserve what is left for future generations. At present we are still able to dream of a day where our children's children can also enjoy the native forest bird songs as we are able to do. I really hope we don't let that opportunity slip through our fingers.
I urge you to please take swift action to save our unique native forest birds found nowhere else in the world.

Thank you for your kind consideration,

Kimberly De Souza
808-542-8279

From:	Briana Delos Santos
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda item C2: DLNR"s purposed strategy to prevent Bird extinction on Maui & Kauai
Date:	Tuesday, March 7, 2023 10:49:04 PM

I DO NOT ACCEPT the Environmental Assessment's Anticipated Finding of No significant Impact (DEA-AFONSI).
I demand an Environmental Impact Statement.

From:	Julia Diegmann
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Strong Support for Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.
Date:	Saturday, March 4, 2023 5:06:18 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I am submitting testimony in strong support of agenda item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

Our native Honeycreepers are foundational to the culture, forests, and ecosystems of Hawai'i. On the island of Kaua'i, we have already lost dozens of forest bird species due to avian diseases transmitted by non-native mosquitoes, among them iconic species like the Kaua'i ʻō'ō, featured in mahiole and ʻahu ʻula, and the spectacular Kaua'i ʻakialoa, a pollinator of ʻōhi'a lehua and insect eater. We are grieving the loss of their song, the loss of their beauty and the loss of their presence.

Of the six remaining Honeycreepers species on Kaua'i today, two are critically endangered. The 'akikiki is going extinct in the wild as you are reading these lines and the ʻakeke'e is predicted to go extinct in the wild within the next couple years. As pollinators, seed dispersers, and insect eaters, they are essential for our forests and without action or delayed action, these species have no chance of survival.

The incompatible insect technique or mosquito birth control provides us with a glimmer of hope and opportunity to save the last remaining Honeycreepers from extinction. This method has been used successfully worldwide for vector control for human diseases and gives us a powerful tool to address the main cause for the decline of our Honeycreepers: avian malaria transmitted by the Southern House Mosquito. Neither the disease nor the vector is native to the Hawaiian islands and the mosquitoes have invaded the highest elevation of our island, decimating our Honeycreeper populations every day. Our forest birds evolved in a mosquito-free Hawai'i and a single bite of an infected mosquito can be enough to kill an ʻi'iwi.

The question to consider for our forests and for our ecosystem: How many more native forest bird species can we afford to lose, before the environmental impact will lead to the collapse of our native Hawaiian forests and watersheds?

Mahalo nui!

- Dr. Julia Diegmann
Kalāheo, Kaua'i

From: anne earhart
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written Comments on Agenda Item C.2- Stopping Hawaii Bird Extinctions
Date: Tuesday, March 7, 2023 9:41:52 AM

To whom it may concern:

I am writing to offer my strongest support for the DLNR-DOFAW project to deal with avian malaria that will surely eradicate all our forest birds. We know that climate change has reduced the safe areas upslope for the birds and there is little time left to prevent extinction of these birds. A single bite can kill an i'iwi.

Yes, these are drastic measures and I hope that you can make it very clear to the public that these are not GMO mosquitoes and that they carry little to no risk to humans.

I hope that the State and it's many partners can move swiftly to implement this project as there is very little time left for these birds and extinction is forever. I realize that this is a cutting edge and ambitious project and that this is exactly what is called for at this point.

Thank you to the State and all of the partners for this work.

Anne Earhart
Kilauea, Kauai

From:	KEITH EVANS
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Testimony for consideration re agenda item C2 at BLNR meeting 3/10/23
Date:	Monday, March 6, 2023 10:59:45 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique (WIIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

These birds are the last vestiges of what once were thriving populations found nowhere else on Earth. They are vital to the health of the Hawaiian upland forest ecosystems, and hold deep cultural significance for native Hawaiians and their ancestors.

Mosquito-borne avian malaria is the primary cause of death for these last few remaining birds. Time was they were safe at the higher elevations as the mosquitoes could not breed in the lower temperatures. Now with climate warming, even this last refuge is fast disappearing. Other techniques have been tried and failed, the bird populations continue to decline precipitously.

The WIIT is the last hope to save the remaining birds. Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2, so that our children can see these birds alive and thriving in the wild, and not as stuffed exhibits in a museum (as is sadly already the case for so many extinct native Hawaiian birds and animals).

Mahalo nui for your consideration,
Keith Evans

AMERICAN BIRD CONSERVANCY

Bringing back the birds

8 March 2023

Testimony of American Bird Conservancy to
Board of Land and Natural Resources
Agenda Item C2: Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kaua'i

Aloha Chair Dawn Chang and Members of the Board of Land and Natural Resources,

American Bird Conservancy **strongly supports DLNR's proposed management actions to prevent the imminent extinctions of forest birds on Maui and Kaua'i**. American Bird Conservancy's mission is to protect wild birds and their habitats. We have been active in Hawai'i for over 15 years, working to protect and restore bird populations across the state, nearly all of which are on the US and State of Hawai'i Endangered Species list. We work on endangered birds across the western hemisphere and the situation in **Hawai'i presents the most significant bird extinction threat we have encountered**. If action is not taken quickly to suppress invasive mosquitoes, several honeycreepers will go extinct in the next few years, and a total of 12 species are likely to follow in the coming decade. The honeycreepers are found only here – they arrived as Kaua'i and Ni'ihau were emerging, and are uniquely, irreplaceably Hawaiian. **This is a true extinction emergency.**

Scientists, land managers, and those connected to the birds have known that southern house mosquito (*Culex quinquefasciatus*) and avian malaria present an existential threat to the Hawaiian honeycreepers for over 55 years – but there were no landscape-scale solutions available. Now, rising global temperatures are allowing these mosquitoes to invade the last forested strongholds for our honeycreepers. On Kaua'i, the collapse of six native forest birds has been linked to avian malaria, indicating that these long predicted impacts of climate change are occurring now. The Critically Endangered 'akeke'e and 'akikiki are experiencing declines of 90 percent or more and could quickly become extinct without urgent action. On East Maui, the kiwikiu and 'ākohekohe face comparable threats of extinction. **But there is now hope** – decades of research have developed tools to protect human health that also provide the possibility of breaking the avian disease cycle and saving these birds from extinction.

ABC, along with experts from across Hawai'i and the world, was involved in the September 2016 To Restore a Mosquito Free Hawai'i workshop (Hawai'i Volcanoes National Park), which evaluated options to control invasive mosquitoes in the state. This group identified the *Wolbachia*-based, biopesticide approach as the best path to prevent the extinction of forest birds in Hawai'i. The group also identified outreach and community engagement as critical to advancing the effort. ABC has been a leader in the Birds, Not Mosquitoes partnership, actively engaging community leaders, elected officials, and other stakeholders; there is broad support and strong demand that we find and implement a solution quickly to prevent the loss of these biologically and culturally important species.

The extensive testing and safe implementation of this technique for human health provides a foundation and invaluable opportunity to implement a similar solution for a conservation purpose. *Wolbachia*-based, Incompatible Insect Technique mosquito control for human health has been approved for several other mosquito species elsewhere in the United States (*Aedes albopictus* in California and Kentucky; *Ae. aegypti* in California, Texas, and Florida, with amendments to add Puerto Rico and the U.S. Virgin Islands; and *Ae. polynesiensis* in American Samoa).

We are racing time, and successful application of this management tool will prevent the extinction of multiple species of invaluable and irreplaceable honeycreepers. They are integral components of our forests, indicating overall ecosystem health and serving as pollinators, seed dispersers, and predators. Their beauty, behaviors, and spiritual connotations are woven into mele, hula, and ʻōlelo noʻeau, and iconic Hawaiian materials created through featherwork. These birds are found nowhere else in the world, and we have a kuleana to protect them. **American Bird Conservancy applauds the efforts of the Department of Land and Natural Resources to save these bird and protect our ecosystems.**

Chris Farmer, Ph.D.
cfarmer@abcbirds.org
Hawaiʻi Program Director
808-987-1779

From:	Joseph Felt
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date:	Wednesday, March 8, 2023 9:17:06 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Joseph Felt

From: Victoria Felt
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Wednesday, March 8, 2023 9:01:29 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2.

Mosquitos have decimated many uniquely Hawaiian species and continue to threaten others. Our native birds are a unique part of our island's identity and must be saved. It's vitally important that we do our part to eliminate introduced mosquitos, while simultaneously preserving the generic diversity of our remaining honeycreepers by bringing some into captive breeding programs.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Thank you for your consideration,

Victoria Felt

Knots In The Pines
Adventure Wedding Photographer and Planner

From: Marjorie Fields
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Forest Bird Extinction Crisis
Date: Tuesday, March 7, 2023 6:16:58 PM

Please conduct additional research about how to save these birds. Don't keep doing what has failed in the past. We need answers. Once the birds are gone, they are gone.

Marjorie Fields
Sierra Club &
Audubon Society

FINCH RESEARCH NETWORK

March 7th, 2023

To the members of the Board of Land and Natural Resources,

The Finch Research Network, a 501(c)(3) nonprofit dedicated to the study and conservation of finches and their habitats globally, would like to take this time to highlight the severity and importance of the briefing you'll be receiving from the DLNR-DOFAW regarding Hawai'i's forest bird extinction crisis. We are writing to you today in **SUPPORT** of Agenda Item C-2.

The Hawaiian honeycreepers are a very diversified group of finches, and as such, have garnered the attention of our organization and members (many of whom are based on the mainland). We are astonished at the rapid pace these species are headed towards extinction, and are working with partners in Hawai'i to ensure these extinctions do not take place.

We would like to emphasize the value in the two tools that are being presented on today - both the use of mosquito control through Incompatible Insect Technique, and through captive care of two of the most endangered honeycreepers (the ʻakikiki and kiwikiu). These are the only tools left in the so-called tool-box, and if we don't employ them, we are guaranteed to lose these birds forever.

Extinctions of Hawaiian birds and birdlife have proceeded at an incredibly rapid pace since contact with Europeans first took place in 1778, and now only 17 of the 50+ species of honeycreepers that used to exist on the island are holding on today.

We hope you will not take this matter lightly, and do all you can to help save these birds that are ʻohana, kūpuna, and ʻaumākua to Native Hawaiians. These birds are only found here and nowhere else in the world. We must do what we can to save them before it is too late.

Thank you for your work,

Matt Young and Nathan Goldberg

Finch Research Network
https://finchnetwork.org

From: kapulei flores
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Wednesday, March 8, 2023 7:11:43 PM

Aloha,

I SUPPORT Agenda Item C-2 which proposes two actions:

1) the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui
2) the establishment of viable populations of two extremely imperiled honeycreeper species - the ʻakikiki and kiwikiu - at conservation breeding centers in Hawaiʻi until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Hawaiʻi is already known as the extinct capitol for many of our native species, but especially for our native birds. We have lost so many and continue to see the decline in our native bird populations from the mountain to the sea. Now more than ever it is beyond important to do everything we can do to save our native birds which includes prioritizing their native natural habitats, native food sources, and understanding their importance in our ecosystem. It is not an option of whether or not we should prioritize making a safe natural and native environment for our native birds to thrive, it is an urgency before we watch our remaining species go extinct right in front of our eyes. Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawaiʻi's honeycreepers through swift, scientifically informed action. **I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.**

Mahalo Nui

From:	Maureen Fodale
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Agenda item todam on c2 for use of Wolbachia
Date:	Thursday, March 9, 2023 8:40:22 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the*Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

I believe our extinction crisis is well underway and must get a serious intervention to save our native bird population--some of the earliest ancestors.

I believe the proposed conservation actions will dramatically help mitigate this crisis while additional efforts to maintain anf grow species can protect and grow populations for return to native forests later under safer conditions.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Thank you.

Maureen Fodale
Friends of King Kaumualii

ʻA ʻohe hana nui ke aluʻia

(No task is too big when done together by all)

Friends of King Kaumualiʻi
P O Box 509
Waimea, HI 96796
652-0021
www.KauaiKingKaumualii.org
Kaumualiiohana@gmail.com

From: Breanne Fong
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to Save Hawaiian Honeycreepers
Date: Tuesday, March 7, 2023 8:44:24 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Breanne Fong

--
Breanne (Bree) Fong
Natural Resources and Environmental Management
University of Hawai‘i at Mānoa

From: Caroline
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 Biopesticide Mosquitoes
Date: Tuesday, March 7, 2023 4:28:58 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I am a former BBC journalist, live TV co-host, Maui homeowner and part-time Maui resident who is STRONGLY OPPOSED to the planned biopesticide mosquito releases on Maui. I demand that a detailed, full-scope Environmental Impact Statement (EIS) is completed documenting the impacts on our native birds, environment, and public health.

To paraphrase the Dalai Lama: "Anyone who thinks they're too small to make a difference has never shared a bed with a mosquito." Now think what a difference the planned annual release in Maui could make of more than 40 billion lab-raised mosquitoes that have been modified by the addition of the bacteria, Wolbachia, What could possibly go wrong? Humans have already done a fine job of releasing invasive species in Maui. Mongoose to kill the rodents in the sugarcane fields. Diurnal mongoose to kill nocturnal rats and mice. Oops! Then three male and six female Axis deer from South Asia were introduced to Maui in 1959. Now more than 60,000 of them are on the island and have devastated pasture forage and vegetation.

Proponents of the DBQ mosquito release scheme insist only male mosquitoes are be used that will mate with existing females in the wild and cause them to lay eggs that will not hatch. However, just one lab-reared female accidentally released can create 160,000 more mosquito females in her 8-week lifespan.

In fact, the DQB Mosquito project comes with many risks, including horizontal transmission of the introduced bacteria strain, increased pathogen infection in mosquitoes, irreversible evolutionary events, population replacement, accidental release of lab-reared females, creation of lab-strain females in the wild, horizontal gene transfer, biopesticide drift, and mosquitoes becoming a better vector of avian malaria and/or West Nile Virus (human and bird) – which would amplify the threat to native birds that these biopesticide insects were introduced to reduce, in effect making the cure worse than the disease. Peer-reviewed studies document these concerns. If the introduction of lab-produced mosquitoes into the wild increases the transmissions of these diseases, it will be extremely damaging to not only the health of Maui's residents, both human and animal, but also to the island's tourism industry which is its main source of income. For example, fears about the Zika virus were said to have lost South America and the Caribbean billions of dollars of tourism revenue.

This biopesticide hasn't been studied in Hawaii's unique ecosystems, nor has it gone through the EPA registration process to examine ingredients, site use; amount, frequency, and timing of use; and storage and disposal practices. Risk assessments to evaluate harms to humans, wildlife, fish, plants, endangered species, and non-target organisms haven't been conducted. Potential contamination of surface water or groundwater, leaching, runoff, and spray drift haven't been evaluated.

The Maui Environmental Assessment (EA) lists numerous potential impacts, including wildland fire, noise effects on wildlife, disturbances to nesting and roosting of special status wildlife species, adverse impacts on critical habitat, threats to endangered nene and Hawaiian waterbirds, risks to forest birds and bats, native plant disturbances and erosion, transport of invasive weeds and diseases/pathogens, and threats to human health and safety. The effects of the release of mosquito packaging on the environment have not been addressed.

Environmental Justice is a concern, and potential disturbances of traditional cultural practices are noted in the EA. 7 Native Hawaiian lineal descendants and cultural experts interviewed all expressed concerns about the impacts and effects this project could have on cultural resources and traditions, native birds, public health, wildlife and our fragile ecosystems. According to the state: "If the project and concerns about the use of this biocontrol discourage practitioners from conducting their traditional or customary practices, it would be an adverse effect to these cultural activities. As a

result of their location, cultural practices, and other factors, Native Hawaiians may have atypical or disproportionately high and adverse human health impacts and environmental effects from exposure to the biopesticide."

According to the U.S. Department of the Interior Strategy: "Wolbachia IIT is a novel tool for conservation purposes and its degree of efficacy in remote forest landscapes is unknown." This statement admits the DBQ project is an experiment on Hawaii's people, wildlife, and land with unknown outcomes. Human disease vectors are involved and informed consent of the public is required. Testimony is apparently over 75% opposed as concerned parties understand that releasing Wolbachia mosquitoes on Maui is very likely to open a Pandora's Box of serious unintended consequences.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Yours sincerely,

Caroline Frantzis.

From:	Chelle Claire
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai
Date:	Wednesday, March 8, 2023 4:50:30 AM

I am a very concerned, citizen of Maui, family, and mother of two young children born on Maui. I'm strongly opposed to the planned biopesticide mosquito releases on Maui! This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown. I do not want my family to be exposed to the "unknown" from this science experiment. Please stop playing God or Mother Nature and trying to create biopesticide mosquitos to release, what is the plan if some thing goes wrong? No plan at all?? It is asinine!
I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Sincerely,

Michelle Galarza
Haiku, HI
Sent from Proton Mail for iOS

From: chelleigh Hoots
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date: Tuesday, March 7, 2023 7:07:15 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Mahalo for your consideration,
Emily Gambino

From: jan gandy
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 7:56:33 AM

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Jan Gandy

From:	Lea-Carol Glennon
To:	DLNR.BLNR.Testimony
Cc:	Dory Shigematsu; Eric ʻIwakeliʻi Tong; Lehua Veincent
Subject:	[EXTERNAL] Testimony for Birds Not Mosquitos proposal, 10 March 2023
Date:	Wednesday, March 8, 2023 7:24:53 PM

Aloha!

The Birds Not Mosquitos program galvanized my students to learn more about the plight of the Hawaiian Honeycreeper species and the root causes of their demise.

I am a High School kumu at Kamehameha Schools-Hawaii campus and I have participated in the citizen science program with Birds Not Mosquitos partnership.

My students collected mosquitos from the Hilo area, extracted the DNA of the mosquitos as well as the endosymbiont Wolbachia sp., and we shared our results with Dr. Renee Bellinger (USGS) who is also doing research in this area.

My students would like to offer this testimony in support of the proposals put forward by Birds Not Mosquitos partnership to mitigate the current extinction rates of these birds due to the human-induced plague of avian malaria.

O wau nō me ka haʻahaʻa,

Lea-Carol Glennon

Lea-Carol Glennon

Biology Teacher
Kamehameha Schools - Hawaiʻi campus
16-714 Volcano Rd, Keaʻau, HI 96749
808-982-0000, ext. 20656

O ke kahua mamua, mahope ke kūkulu
The site first, and then the building. Learn all you can, then practice.

From:	Leslie
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Comment: I"m opposed to the mosquito release plan
Date:	Wednesday, March 8, 2023 5:08:11 AM

ATTN: for BLNR Meeting 3/10/23 9:15am Agenda Item C2:
"Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I am opposed to the planned biopesticide mosquito releases on Maui, and want an Environmental Impact Statement. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS). I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

Thank you for your attention to this matter.

--
Leslie Goldsmith
"If you change the way you look at things, the things you look at change." Wayne Dyer
770-646-8031
lgoldsmith4@gmail.com
www.neuropatholator.com for patient education at the speed of sight
www.n8art.com for unique handmade flame work jewelry, marbles and more

From: Noah Gomes
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony for Agenda Item C-2 for the BLNR Meeting on 3-10-23
Date: Wednesday, March 8, 2023 3:48:46 PM

To Chair Designate Chang and the members of the Board of Land and Natural Resources,

I am writing to show my **SUPPORT of Agenda Item C-2**, regarding the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of native Hawaiian honeycreepers.

I am a part-Hawaiian researcher with ancestry from Lānaʻi and Kauaʻi. I received my B.A. and M.A. in Hawaiian Studies from the University of Hawaiʻi at Hilo and am an active cultural practitioner.

The focus of my M.A. research was on the traditional hunting of birds in Hawaiʻi for feathers, food, and other purposes. While we do not hunt native birds today, I believe it is possible for us to regain that connection with them if we can spend the effort necessary to stabilize this natural resource.

Birds continue to be relevant to native Hawaiian cultural practitioners today in spite of the difficulty in obtaining them for everyday use. There is a high demand in the community for native bird feathers and skins for kāhili and ceremonial use. There is a high demand for the use of bird bones for traditional tattooing. There is a demand for the use of birds as a traditional food. I am certain that if we could bring populations of our native birds back up, they will be a great benefit to the Hawaiian people.

I am sure that many other testifiers will write to you about the ecological importance of our native birds. I would also add to that the spiritual and practical importance of native birds to native Hawaiians. They are in our stories, our poetry, they are forms taken on Earth by our ancestors, and they serve to ensure the fruitfulness of the land for our use in countless ways.

The extinction crisis in Hawaiʻi has been out of control for some time. The following few years may be our very last opportunity to prevent a disaster that could permanently affect the health of our forests and other ecosystems. I strongly encourage you to take whatever steps are necessary to prevent this from happening. Your decisions on this matter will change the fate of our islands.

I welcome further dialogue with any of you, please feel free to reach out to me.

Mahalo,

Noah J. Gomes
Hilo, Hawaiʻi

From: John Gordines
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] support for Agenda Item C-2
Date: Tuesday, March 7, 2023 6:34:36 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,
I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.
I believe our extinction crisis ….
I believe the proposed conservation actions….
Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.
John Gordines

J O H N & T H E R E S A G O R D I N E S
p. 1 855 807 9020
e. gordines@kauaiflowers.com
www.kauaiflowers.com

From: Kaki Gould
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Mosquito release must be stopped before it's too late. We need an environmental impact statement done.
Date: Thursday, March 9, 2023 7:54:23 AM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

I,am opposed to this mosquito release plan and want an environmental impact statement done.

Mahalo, Kaki Gould

Sent from my iPad

From: donna grabow
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] In favor of comprehensive Environmental Impact Statement
Date: Tuesday, March 7, 2023 7:57:07 PM

Aloha

I attended one of the "BIRDS, NOT MOSQUITOES" presentation, and was impressed with the staff of the Dept. of Agriculture, who were very well-prepared.

The speakers were able to persuade the some of the public to agree with the BLNR's proposed plan (to release thousands of laboratory mosquitoes weekly) by promising the safety of the lab mosquitoes.

According to the Dept. of Agriculture, their Environmental Assessment concluded that there is ***No Significant Impact.***

The risks involved with the experimental plan, does ***require a detailed, comprehensive study*** *of the* impacts to the public health, birds, wildlife, and environment.

I oppose the release of any lab mosquitoes on any island in Hawaii.

Sincerely,
Donna Grabow
Moku o Keawe

From:	Jericho Granadosin
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Wednesday, March 8, 2023 1:11:38 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of Wolbachia bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: Cindy G
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] March 10 2023, Agenda Item C-2
Date: Tuesday, March 7, 2023 9:55:12 AM

Re: Hawaii's Forest Bird Extinction Crisis Management Steps

I was a volunteer for ten years at Keauhou Bird Conservation Center on Big Island where they captive breed endangered Hawaii forest birds. I saw how very difficult, time-consuming and expensive it is to captive breed critically endangered birds. To then put these birds back into the wild to see them killed by disease carrying mosquitoes is devastating. Why not instead focus on control of the mosquitoes? It makes so much more sense to do everything we now know about eradicating or at least minimizing mosquito populations. Humans are responsible for bringing these invasive pests to Hawaii and we have a responsibility to eradicate them so that our endangered native forest birds have a chance to thrive.

Thank you for your time.

Cindy Granholm
Volcano, Hawaii

From:	Leahi Hall
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Testimony in support of Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Tecnnique
Date:	Monday, March 6, 2023 9:03:23 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

Our honeycreepers, once a diverse group of more than 50 species, only have 17 species remaining today, and some of those with fewer than 500 individuals left. Please support the Incompatible Insect Technique and proposed conservation actions to prevent further extinction via avian malaria carried by infected mosquitoes.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2. Our honeycreepers are an invaluable part of Hawaii Lifeways. The health of our people is the health of our birds is the health of our lands.

Mahalo nui,

Leahi Hall

Kākoʻo (Support) Oli Honua: https://www.kekuhi.com/oli-honua

Learn More About Lonoa Honua Programs + Access Course Content: https://www.kekuhi.com/

From: Netra Halperin
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] The Wolbacia mosquito project needs a full environmental assessment
Date: Saturday, March 4, 2023 4:49:16 PM

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are in general, when man tries to interfere with nature, he only creates more problems. This is absolutely the case here. Instead of focusing on mosquitoes, you should be focusing on toxic, pesticides, herbicides, and EMFs in the area of this song birds

SUSAN HALPERIN, Kihei, Maui

Sent from my iPhone

From:	Erika Hampton
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Saturday, March 4, 2023 6:31:36 PM

I am opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Additionally, I would like to know who to hold accountable for damages if and when this experiment goes wrong.

Do the right thing!

Sincerely,
Erika-Lee

March 7, 2023

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I have worked as a professional ecologist in Hawaii for more than 30 years and **I strongly SUPPORT, Agenda Item C-2** on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui. Honeycreepers had been in Hawaii for over 6 million years before the first humans arrived. The Hawaiians formed deep and lasting connections with these birds, as they were among the only land animals present at that time. The song of these birds informed oli (chant) and song (mele) and their feathers were used in ʻahuʻula (capes) and mahiole (helmets) worn by aliʻi. The remaining honeycreepers continue to be ecologically important as pollinators of native plants and dispersers of native plant seeds. The proposed use of IIT to save remaining honeycreepers on Maui and Kaui is an incredible, well researched tool to stop the decline of these birds. Mosquitoes are not native to Hawaiʻi and they play no positive ecological role in any ecosystem here. Their decline or elimination in certain critical habitats would have no negative ecological effect, as no native plants or animals depend on them for food or pollination. While new species of microbes and insects are inadvertently brought to Hawaii each day on ships and planes, the IIT approach proposed here does not introduce **any** new organisms into our environment. I cannot think of any action that could have such a major positive effect on our remaining native birds at such little ecological cost. Technology has finally made it possible to control mosquitoes at the landscape scale to save our remaining birds. I truly believe that we owe it to future generations to act now.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!

Patrick Hart
Professor and Chair
Dept. of Biology
University of Hawaiʻi at Hilo
200 W. Kāwili Street
Hilo HI 96720
ph. 808-932-7182
Office: STB 115
pjhart@hawaii.edu
http://LOHElab.org
ManuMinute on Hawaii Public Radio

From: Christina Hartman
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C-2 insect technique
Date: Wednesday, March 8, 2023 4:03:04 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

I believe our extinction crisis is at a critical turning point and it is important that we act now to help stop further loss of our native birds.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
--
Christina

For the Protection of Hawai'i's Native Wildlife
HAWAII AUDUBON SOCIETY
850 Richards Street, Suite 505, Honolulu, HI 96813-4709
office@hiaudubon.org https://hiaudubon.org/

March 8, 2023

TO: Hawai‘i Board of Land and Natural Resources

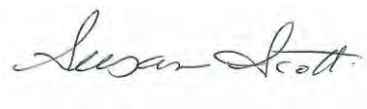
RE: Hawai‘i’s Forest Bird Extinction Crisis

The Hawai‘i Audubon Society’s Board of Directors strongly supports the management steps being taken and proposed by the the Department of Land and Natural Resources-Division of Forestry and Wildlife to prevent more native forest bird extinctions from occurring.

These steps include habitat protection through mosquito control using the Incompatable Insect Technique, as well as securing populations of the critically endangered ‘akikiki and kiwikiu in captivity.

Founded in 1939, the Hawai‘i Audubon Society is the oldest nonprofit conservation organization in Hawai‘i. In this our 84th year of existence, we continue working toward the founders’ missions of education about, and protection of, Hawai‘i’s native birds.

Sincerely,



Susan Scott, President
Hawaii Audubon Society
https://hiaudubon.org/

HUI HO'OMALU I KA 'AINA
ADVOCATES FOR NATIVE KNOWLEDGE

March2023

Department of Land and Natural Resources
Board Testimony March 10, 2023
Item C-2

Aloha Chair Designee Chang and Members,

Our organization was created to support actions to address threats to our natural, cultural and economic resources in Hawaii.

WE SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

Our native forest birds are nearly gone and we have this one last opportunity to save the few remaining.
Specifically

- Avian malaria, a disease transmitted by invasive southern house mosquitoes, is driving the extinction of our forest birds.
- A single bite by an infected mosquito can kill an ʻiʻiwi.
- As the climate warms, mosquitoes carrying avian malaria are moving upslope into the last refugia for Hawai'i's forest birds.
- The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds.

We have been active advocates for and partners with those who study and work to address these threats.
The issues addressed by the proposal described in item C-2 of this agenda are exactly those**; natural, cultural and economic threats to Hawaii.**

Please support the actions proposed in this agenda item C-2.
Mahalo, me ka pono,

Makaala Kaaumoana
Vice Chair

Hui Hoʻomalu i ka ʻĀina is a taro root organization founded in the early 1980's by traditional practitioners of moku Halele'a to address threats and impacts to the natural and cultural resources of Kaua'i. Founded by farmers and fishermen, weavers and hunters, we seek to provide context for issues related to the ecology of our ahupua'a. The organization is an active advocate for those native things and ways that are disappearing. We are not a nonprofit, we are an activist organization. We do not whine and wait, we act.

From: chris hi
To: OLMS_BLNR_Testimony
Subject: [EXTERNAL] The Mosquito program could be the third medical disaster by the Gates Foundation
Date: Wednesday, March 8, 2023 6:26:36 PM

THE GATES FOUNDATION IS SPONSORING A WORLD MOSQUITO PROGRAM USING THE WOLBACHIA BACTERIUM.

https://www.gatesphilanthropypartners.org/perspectives/2022-world-mosquito-program

BILL GATES & HIS BILL & MELINDA GATES FOUNDATION ARE THE MAIN PROPONENT AND INVESTOR IN THE COVID VACCINES.

This is like how Gates monopolized computer software, Gates is monopolized global health.

https://www.corbettreport.com/gates/

THE PFIZER COVID VACCINE TRIALS PROVE THE VACCINES CAUSE MORE DEATHS & ILLNESS THAN WITHOUT.

The Pfizer vaccine trials:

In the Pfizer 16 and older trial more people died and got sick with the vaccine overall. But less people got sick and died with COVID. Reducing overall sickness and death overall should be end goal, not just reducing COVID sickness and death.

In the 12-15 year old trial, 12 year old girl Maddie de Garay loss the use of her legs, is wheel chair bound and has to eat through a feeding tube. She was only one of a 1,005 vaccinated. She was hospitalized within 24 hours of receiving the vaccine. Pfizer's report said as her symptoms were just abdominal pain.

https://rumble.com/vqx3kb-the-pfizer-inoculations-do-more-harm-than-good.html

https://www.canadiancovidcarealliance.org/wp-content/uploads/2021/12/The-COVID-19-Inoculations-More-Harm-Than-Good-REV-Dec-16-2021.pdf

PFIZER HAS THE LEAST NEAR TERM DEATHS PER VACCINATION, THEN MODERNA, J&J THE MOST.

This is according analysis of the Vaccine Adverse Events Reporting System (VAERS) done by Vaccine Safety Research Foundation founded by Steve Kirsch.

This means that the other vaccine trials have worse the results &/or were rigged more than Pfizer's.

THE FDA APPROVED THE HAZARDOUS COVID VACCINES BECAUSE BIG PHAMA CORRUPTED THEM.

The FDA gets 75% of its drug related funding from big pharma. The former FDA top commissioner Stephan Hahn is now working for Moderna's venture capital investor. The previous FDA Scott Gottlieb commissioner is now on Pfizer's board. Former FDA deputy director Curtis Wright IV helped Purdue Pharma market the opioids as less addictive. Wright than went to work for Purdue Pharma about a year after he left the FDA.

https://www.forbes.com/sites/johnlamattina/2018/06/28/the-biopharmaceutical-industry-provides-75-of-the-fdas-drug-review-budget-is-this-a-problem/?sh=1f6faf1a49ec

PREDICTABLY, DEATHS ARE HIGHER IN 2021 THAN 2020 BECAUSE OF THE VACCINES.

Rasmussen Poll: More Than 1-in-4 Think Someone They Know Died From COVID-19 Vaccines

https://www.rasmussenreports.com/public_content/politics/public_surveys/crosstabs_2_vaccine_deaths_december_28_30_2022

The US COVID vaccine rollout was in December 2020. Edward Dowd, "From February 2021 to March 2022, millennials (born 1981-96) experienced the equivalent of a Vietnam war, with more than 60,000 excess deaths. The Vietnam war took 12 years to kill the same number of healthy young people we've just seen die in 12 months."

"The vaccination rate, particularly among working people, rose extremely fast in a short amount of time. I would soon confirm that being employed in 2021 was actually detrimental to your health."

Dowd, Ed. "Cause Unknown": The Epidemic of Sudden Deaths in 2021 & 2022

https://www.amazon.com/Cause-Epidemic-Sudden-Childrens-Defense/dp/1510776397/ref=sr_1_1?crid=3GSKCVMWG0VB&keywords=Dowd%2C+Ed.+%22Cause+Unknown%22%3A+The+Epidemic+of+Sudden+Deaths+in+2021+%26+2022&qid=1674533131&s=books&sprefix=dowd%2C+ed.+cause+unknown+the+epidemic+of+sudden+deaths+in+2021+%26+2022+%2Cstripbooks%2C778&sr=1-1

Life insurance data shows peak excess deaths in the 3th quarter of 2021 in the working age group. This is shortly after the federal vaccine mandates. Life insurance data is in the SOA Research Institute "Group Life COVID-19 Mortality Survey Report." See Table 5.6 - Excess Mortality by Detailed Age Band, page 23.

https://www.soa.org/48ff80/globalassets/assets/files/resources/research-report/2022/group-life-covid-19-mortality.pdf

AFTER VACCINATION COVID DEATHS WENT UP IN SEVERAL COUNTRIES

This happened in South Korea, Thailand, Malaysia, Uganda, Nepal, Portugal, Mongolia, Zambia, Paraguay, Bahrain, Uruguay, Tunisia, Sri Lanka, Afghanistan, Taiwan, Israel and Vietnam. In initially low COVID death countries, the change was dramatic.

https://childrenshealthdefense.org/defender/covid-vaccine-deaths-cause-unknown/

This could be because of Antibody Dependent Enhancement (ADE) that Nobel Prize winning scientist and French virologist Luc Montagnier warned about. Prof. Montagnier said, "the curve of vaccination is followed by the curve of deaths."

https://vaccineimpact.com/2021/french-nobel-prize-winning-virologist-professor-the-covid-19-shots-are-creating-variants/

Antibody Dependent Enhancement (ADE) is where the antibodies from the old vaccine helps the new variant progress. It happened before in SARS vaccine animal studies. Because of this SARS vaccines were stopped. SARS virus is about 78% the same as COVID.

COVID is a single strand RNA virus. Other vaccines for single strand RNA virus have been problematic such as Dengue fever & RSV.

This is a study outlining this risk & saying "informed consent" is needed.

https://pubmed.ncbi.nlm.nih.gov/33113270/

THE GATES FOUNDATION HAD A PRIOR VACCINE FAILURE. GATES' ORAL POLIO VACCINE PARALYZED OVER 490,000 PEOPLE IN INDIA.

The Gates foundation promoted the use of oral polio vaccines even though it was discontinued in the US. The advantage of the oral polio vaccine is lower cost.

This caused a resurgence of polio that originated from the vaccine.

Lakh is an Indian word for 100,000, 4.9 lakh = 490,000.

https://www.gatesfoundation.org/our-work/programs/global-development/polio

https://www.npr.org/sections/goatsandsoda/2017/06/28/534403083/mutant-strains-of-polio-vaccine-now-cause-more-paralysis-than-wild-polio

https://www.thehindu.com/news/cities/Delhi/vaccine-induced-paralysis-calls-for-action-says-study/article24740588.ece

BILL GATES SAID IN 2010 TED TALK THAT A REDUCTION IN POPULATION IS NEEDED TO REDUCE CO2.

Gates said we have reduce CO2 to zero. His formula is CO2 = People x Services Per Person x Energy Per Service x CO2 Per Unit Energy.

"So let's look at each one of these, and see how we can get this down to zero. Probably, one of these numbers is going to have to get pretty near to zero."

"First, we've got population. The world today has 6.8 billion people. That's headed up to about nine billion. Now, if we do a really great job on new vaccines, health care, reproductive health services, we could lower that by, perhaps, 10 or 15 percent."

https://www.ted.com/talks/bill_gates_innovating_to_zero/transcript

AFRICA IS STARKLY UNVACCINATED, AND STARKLY UNVANQUISHED BY COVID

https://www.zerohedge.com/covid-19/africa-starkly-unvaccinated-and-starkly-unvanquished-covid

AFRICA IS PLAGUED BY MOSQUITOES, A MOSQUITO "ACCIDENT" WOULD ACCOMPLISH A DEPOPULATION OF AFRICA THAT THE VACCINES DID NOT.

https://www.cdc.gov/malaria/about/distribution.html

From: Ethan Hill
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Wednesday, March 8, 2023 4:05:03 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:
the use of the Wolbachia Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui
the establishment of viable populations of two extremely imperiled honeycreeper species - the ʻakikiki and kiwikiu - at conservation breeding centers in Hawaiʻi until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawaiʻi. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ʻōhiʻa. Hawaiʻi residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawaiʻi.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kauaʻi. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawaiʻi can be used as temporary holds for ʻakikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawaiʻi's honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Ethan Hill

From: whalemail@waypt.com
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Preventing Extinction of Island Forest Birds
Date: Monday, March 6, 2023 2:11:48 PM

Aloha,

I urge you to respond to the scientifically sound projects aimed at saving critically endangered forest birds. When I first came to Kauai just prior to Iniki, we all believed the O'o was still present on Kauai. Sadly, this beautiful bird is no longer living, adding its demise to the long list of other birds we have not been able to save.

While we did not yet understand the impact of climate change when we lost the O'o, we now know warmer temperatures are encouraging mosquito populations to move into hight elevations.

Proposed mosquito control is urgently needed along with other habitat actions. In my small role as author of children's books helping young people to take action, such as planting koa and chia, I have gotten to know the on the ground leaders in protecting island forest birds and the overall forest environment.

I urge you to take quick action to help those working so hard to prevent further extinctions.

Mahalo nui for your attention to this need,

Ron HIischi
PO Box 22
Poulsbo, Washington 98370

From: kevin hoeke
To: DLNR.BLNR.Testimony
Cc: Holly Malloy
Subject: [EXTERNAL] Re: Testimony OPPOSED to BioPesticide Mosquito Release on Maui
Date: Wednesday, March 8, 2023 9:01:21 PM

Im a CA environmental attorney and its obvious to me that this project requires the highest level of environmental evaluation and documentation.

totally inadequate thus far.

this is a novel project in this ecosystem

risks are huge

more evaluation!!

Thank you,

Kevin

Law Office of Kevin Hoeke
SBN 157935
P.O. Box 44
Soquel, CA 95073
831.421.1072
www.hoekelaw.com

From: Spirit <swaroop@spiritofaloha.org>
Sent: Wednesday, March 8, 2023 2:56 PM
To: blnr.testimony@hawaii.gov <blnr.testimony@hawaii.gov>
Subject: Testimony OPPOSED to BioPesticide Mosquito Release on Maui

Aloha,

My name is Fredrick Swaroop Honig, I have served as the director of the Spirit of Aloha Nature Sanctuary in Haiku for almost 30 Years.

We are an official National Wildlife Federation Sanctuary.

We are adamantly OPPOSED to the planned biopesticide mosquito releases on Maui and

we

request that a full Environmental Impact Study be completed. We have more endangered birds In Hawaii than in all other 49 states combined. The Potential risks to our endangered birds outweighs the possible benefits. We can demonstrate for you ways that we have successfully an organically controlled mosquito populations with urns of mosquito eating guppies that are natural to all the streams of Hawaii.

May our beloved Mother Maui & all of her inhabitants be protected from these serious risks & unknown outcomes!

Would you please confirm that you have received & registered our written testimony? Thank you! Please let us know if you would like to visit and see how we are controlling Mosquitos naturally,

Respectfully Submitted,

Mahalo Nui Loa,

Fredrick Swaroop Honig
Gardens' Trustee
Phone: 808.572.2300
www.spiritofaloha.org

From: Spirit
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony OPPOSED to BioPesticide Mosquito Release on Maui
Date: Wednesday, March 8, 2023 12:56:50 PM

Aloha,

My name is Fredrick Swaroop Honig, I have served as the director of the Spirit of Aloha Nature Sanctuary in Haiku for almost 30 Years.

We are an official National Wildlife Federation Sanctuary.

We are adamantly OPPOSED to the planned biopesticide mosquito releases on Maui and we

request that a full Environmental Impact Study be completed. We have more endangered birds In Hawaii than in all other 49 states combined. The Potential risks to our endangered birds outweighs the possible benefits. We can demonstrate for you ways that we have successfully an organically controlled mosquito populations with urns of mosquito eating guppies that are natural to all the streams of Hawaii.

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Respectfully Submitted,

Mahalo Nui Loa,

Fredrick Swaroop Honig
Gardens' Trustee
Phone: 808.572.2300
www.spiritofaloha.org

From: Meenakshi Honig
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSED to BioPesticide Mosquito Release on Maui
Date: Wednesday, March 8, 2023 11:22:42 AM

Aloha~

My name is Meenakshi Honig. I am grateful to be a long time resident of Maui. I am a teacher, speaker, author & licensed minister in the state of Hawaii.

I am adamantly OPPOSED to the planned biopesticide mosquito releases on Maui for the reasons stated below.

I demand an Environmental Impact Statement (EIS).

May our beloved Maui & all of her inhabitants be protected from these serious risks & unknown outcomes!

Would you kindly confirm that you have received & registered my written testimony? Thank you!

Sincerely, Meenakshi Honig

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

S. Kuʻualoha Hoʻomanawanui
46-320 Haʻikū Rd.
Kāneʻohe, Koʻolaupoko, Oʻahu

March 7, 2023

Aloha BLNR members,

My name is S. Kuʻualoha Hoʻomanawanui. I am Native Hawaiian born in Kailua, Koʻolaupoko, Oʻahu, and raised in Wailua Homesteads, Puna (Kawaihau), Kauaʻi. I spend much time over the decades in the mountains of Kauaʻi, primarily in the Nounou ("Sleeping Giant") to Keahua ("Loop Road") forest reserve region, my front and back yards, so to speak, hiking and horseback riding and enjoying our beautiful mountain forests with family and friends. Many days of my teen years were consumed with leading guided horseback riding tours for Highgates Ranch in the 1970s-80s in the Wailua Game Management/Kuilau Trail area, and swimming in ponds and streams from "Loop Road" to "Blue Hole." In all these years, I never had the opportunity to see any native forest birds that were once plentiful in this region. I would love to see the environmental conditions (such as eradication of avian malaria-carrying mosquitoes) so perhaps some of our native birds can be reintroduced here, as the ʻalalā have been reintroduced to the dryland koa forests on Hawaiʻi Island.

I have been fortunate, however, to see ʻiʻiwi and ʻapapane active in the forests of Kokeʻe on the other side of the island. In recent years, however, I have noticed a decline in sighting these birds on trips there. I would be thrilled to see their populations increase and thrive once again. While I now live on Oʻahu and don't hike as frequently, coming across ʻapapane along the ʻAiea loop trail is a magical experience. Our endangered birds are precious, and we must do what we can to support and save them, as they exist nowhere else on the planet.

I am in support of the DLNR-DOFAW's proposed strategies to protect and prevent the further decimation and extinction of our beloved native Hawaiian forest birds. I have been aware of the impacts of avian malaria on our native forest birds for many decades, and am cautiously optimistic the proposed Incompatible Insect Technique (IIT) will provide relief for these critically endangered birds. I have carefully read through the science, and believe it is sound and can work. I am usually sceptical of introducing new (foreign) species to control current pests, as there are examples of how that has failed miserably in the past. However, I do believe this strategy has the ability to work. In addition, the capture and raising in captivity of other endangered species such as the ʻalalā has proven successful. Thus I also support the plan to secure and protect populations of ʻakikiki and kiwikiu.

I am an educator with over thirty years experience teaching, researching, and publishing in the area of Hawaiian culture and language, and specialize in 19th century Hawaiian moʻolelo (literature). It is through my extensive reading of Hawaiian moʻolelo that I have come to love and appreciate our native forest birds beyond my experiences seeing them in their forest

home. Our traditional Hawaiian moʻolelo are clear in demonstrating their value to Hawaiians in many ways. To see them thrive once more so we may all appreciate their special place in these islands and the world would be wonderful.

While I cannot work directly to help these precious bird species, growing up on Kauaʻi we actively helped downed uaʻu (shearwater) fledglings by driving them to designated drop off points. Over the past three years I began volunteering driving uaʻu and other downed native seabird species to safety and care, or working with others to do so. It is very fulfilling work. It is also a kuleana (responsibility) I feel very strongly as a Hawaiian, and a very important way to mālama ʻāina not enough people think about. I appreciate the opportunity to provide written support for our native forest birds, and hope it can assist in their protection and care.

Thank you for your time and attention, and for all the important work caring for our ʻāina that you do.

me ke aloha,

S. Kuʻualoha Hoʻomanawanui, PhD

From: Susan Horie
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Experimental Mosquito Release on Maui
Date: Wednesday, March 8, 2023 7:06:21 AM

NO, NO, NO, NO to the proposed genetically modified mosquito release experiment. Have we not learned our lessons regarding unintended consequences? What kind of irreversible impacts may be generated if the models fail to work precisely as planned? What kind of impact will even a minuscule deviation from the model occur. I OBJECT strongly to this unstudied program.

Susan Horie
P.O. Box 1936
Honokaa, HI 96727

From:	Ali
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date:	Tuesday, March 7, 2023 9:53:33 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

> the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
> the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Alexandria Huetter

From: Sarah Hummel
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date: Tuesday, March 7, 2023 8:58:33 AM

To whom it regards,

I am opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

With consideration to the health of our precious planetary harmony,
Sarah Hummel

From: Pete Jalbert
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Forest Birds Agent Item C-2 March 10th
Date: Monday, March 6, 2023 1:20:09 PM

Aloha,
Extinction is forever. A simple three word slogan that always stuck with me. Our forest birds are facing critical threats due to invasive species, avian malaria and climate related changes. The state needs to be pulling out all of the stops to protect our native birds. That includes dealing with our feral cat population. That includes introducing mosquitoes carrying Wolbachia. I urge your support. If we wait any longer, it will be too late.

Mahalo,

Joseph “Pete” Jalbert
Makawao, HI

From: Hotmail
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] I do not want the mosquito release to happen
Date: Tuesday, March 7, 2023 11:39:55 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

C.S.Jenkins
71-1627 aPUU LANI PL. B26
KAILUA KONA, HI 96740

From:	Christian Jimenez
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Wednesday, March 8, 2023 1:13:48 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: Kristen Jordan
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 8:40:56 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

> the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
> the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Kristen Jordan

Resident of Kapa’au, Hawai’i Island

From:	Amanda Joya
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] 03/10/23 DLNR-DOFAW Agenda Item C-2 Testimony
Date:	Tuesday, March 7, 2023 5:46:18 PM

Aloha Chair Designate Chang and members of the Board of Land and Natural Resources,
I SUPPORT Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

I have recently learned that the Nā Manu Nahele, Native Forest Birds of Hawai'i provide a significant contribution to Hawai'i's ecosystem through pollination and seed dispersion throughout our islands. Additionally, our Native Hawaiian birds play a huge role in Hawai'i's history. Historically, over 115 endemic species of honeycreepers in Hawai'i roamed the lands and have major contributions to our beautiful islands with more than 50 species of honeycreepers. Unfortunately, these birds are subjects of major threat with decreasing populations and lack of elevation distribution mainly due to *avian malaria*, which is one of the major causes of extinction for most of these birds. Today, it is sad to say that there are only 17 species surviving for their lives on our islands, and the need for **immediate attention, severe restoration, and conservation management is absolutely crucial** for our cherished birds. An example of action could be the funding support in **developments for mosquito birth control** that would control the population of these insects that greatly contribute to the decreased populations of our honeycreepers. I would greatly appreciate your consideration for this bill to provide protection for our beloved honeycreepers. Mahalo nui for your time and consideration.

Sincerely,
Amanda Joya
MS Graduate Student Research Assistant
BS Food Science and Human Nutrition
University of Hawai'i at Mānoa
Department of Human Nutrition, Food & Animal Sciences

From: kanaloaleohano
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE
Date: Tuesday, March 7, 2023 8:46:30 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

From:	Kauai Yoga on the Beach
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Subject: OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Tuesday, March 7, 2023 6:08:21 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

--
Kauai Yoga on the Beach
ALOHA Kaua'i Yoga & Peace Festival
808 635 6050

From: Tiffani Keanini
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23: Support for Agenda Item C-2
Date: Wednesday, March 8, 2023 8:57:19 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I am submitting testimony in support of Agenda Item C-2 on the proposed management strategy and use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui.

Kaua’i only has 6 Honeycreeper species remaining today, my children and I will witness the extinction of more of our native forest bird species if additional management techniques are not implemented soon. Our native forest birds' populations will continue to decline from avian malaria, a mosquito transmitted disease, as the invasive southern house mosquito encroaches on more and more of their habitat. The proposed management strategies in agenda item C-2 will address this and help mitigate the detrimental impact invasive mosquitoes have on our native Honeycreepers. The Incompatible Insect Technique provides a promising tool to help suppress mosquito populations to prevent further extinction and save our forest birds. This method has been successful around the world as a vector control for mosquito-borne human diseases and Hawaii now has the opportunity to use it here for the benefit of our native forest birds.

Please support the proposed management strategies to help save our native forest birds before it is too late.

Mahalo nui,
Tiffani Keanini
Lawai, Kaua’i

From:	Josephine KELIIPIO
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Wednesday, March 8, 2023 3:52:16 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Mahalo,
Josephine Keliipio
Kona resident

From:	Mary Lu Kelley
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Please support the HAWAIIAN FOREST BIRD CONSERVATION STRATEGIES FOR MINIMIZING THE RISK OF EXTINCTION: BIOLOGICAL AND BIOCULTURAL CONSIDERATIONS
Date:	Monday, March 6, 2023 2:27:40 PM

Aloha,

I am writing in support of efforts to save our native birds. As we know, Hawaii's forest bird community has the highest percentage of endemic bird species, found nowhere else in the world. These endemic forest birds are ohana, aumakua and kupuna to Native Hawaiians, and the habitat in which they are found are sacred places. Climate change has led to the continued encroachment of the southern house mosquito (Culex quinquefasciatus), which carries avian malaria, into the high elevation forests that once served as refugia for these endangered forest birds. Owing to their high susceptibility to avian malaria, these species are threatened with extinction in the near term.

I am in complete support of the HAWAIIAN FOREST BIRD CONSERVATION STRATEGIES FOR MINIMIZING THE RISK OF EXTINCTION: BIOLOGICAL AND BIOCULTURAL CONSIDERATIONS by employing Wolbachia IIT to reduce the presence of southern house mosquitoes (and avian malaria) in critical forest bird habitat, and to collect and maintain viable captive populations of the two species most threatened with extinction from avian malaria and release them once mosquitoes are controlled 3 on the landscape.

Please continue your support for this most important work to save our native birds!!

Thank you,
Mary Lu Kelley
{PO Box 289
Lawaii, HI 96765

From:	Gail Kelly
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] I Oppose Agenda Item C2 Mosquito Release
Date:	Wednesday, March 8, 2023 4:49:05 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health****.* ***I Demand an Environmental Impact Statement (EIS).***

Gail Kelly
HC 1 Box 5383
Keaau, HI 96749

From: Lisa Kerman
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda C32
Date: Tuesday, March 7, 2023 6:32:13 PM

Aloha,

I've been a resident of Kauai for 12 years and I'm opposed to the planned biopesticide mosquito releases on both Kauai and Maui.This project is an experiment on our island homes. There are serious risks, and the outcome is admittedly unknown. I demand a full Environmental Impact Statement be done to determine what hazards could come from this release. This is the responsible thing to do.

Thank you,
Lisa Kerman
hike2heaven@yahoo.com

Sent from my iPad

From: Mele Khalsa
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] testimony in support of item C2
Date: Tuesday, March 7, 2023 1:16:45 PM

I **SUPPORT** this initiative to save native birds from extinction. I believe we have a kuleana to protect the creatures around us from the impacts that we humans have caused by unintentionally bringing invasive species to these islands. Mosquitoes are invasive and they have no place here in Hawai'i. In my lifetime I have watched the manu nahele become more and more rare. When I was a keiki I remember walking through the native forests seeing and hearing beautiful native birds all around. Now the forests are quiet, the glimpses of the birds are less frequent. I don't want to see more of these special creatures go extinct in my lifetime, so that is why I **SUPPORT** this initiative.

I also **TRUST** that this project is **SAFE**. This kind of mosquito release has happened many times in many places to suppress human diseases. I am filled with **HOPE** that this technology can be used to save our birds. I **TRUST** that this is **SAFE, EFFECTIVE**, and has gone through all the necessary regulatory steps. Let's not delay this any further by demanding an unnecessary EIS.

Mahalo,

Mele Khalsa

From: Rachel Kingsley
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support for the proposed actions to prevent the Hawaiian Forest Bird Extinction Crisis
Date: Thursday, March 9, 2023 8:24:31 AM

Aloha kākou,
I am writing today to share my personal support of the proposed actions to help save our Hawaiian honeycreepers. I first moved to Hawai‘i in 2008. In my time here I have been fortunate to experience some of the most magical moments studying, caring for, and enjoying the endemic bird species. I have grown to love these birds and recognize their voices when they are calling. I enjoy pointing them out to those around me with the hopes that they too will know them and understand how truly special they are. Unfortunately in my time here I have also begun to realize that some of those voices I have grown to know and love have become silent. Population numbers are crashing and species are disappearing. Extinction is real. It is happening. This is an emergency that we need to wake up and face. Hawai‘i once had over 50 species of native honeycreepers, today there are only 17. Some are hanging on by a thread. Often I think to myself if generations that have come before me had done just a little more or had the tools to save species what would we still have? Would the po‘ouli or o‘u still be here? Would we know their voices like we know the ‘i‘iwi?
Today we have those tools and we can do something. We are standing on the edge of facing a mass extinction worldwide. Will we take the actions needed and start to save our species? Or will we let their voices go silent? I am reminded of the quote by Chief Seattle “We do not inherit the earth from our ancestors, we borrow it from our children.” Will the next generation look back and hope that we had done more to save species? Will they wonder who the ‘akikiki were or be able to hear the song of the kiwikiu in the wild? I encourage you to please support the proposed actions that have been presented to you today to help prevent the extinction crisis of the Hawaiian forest birds.

Mahalo,
Rachel Kingsley

From:	Amanda Kwiatkowski
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Saturday, March 4, 2023 7:54:30 PM

I STRONGLY OPPOSE the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: jin laihook
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony.
Date: Tuesday, March 7, 2023 10:47:59 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

-IK

From: Cody Lane
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] 3-10-23 Agenda Item C-2
Date: Wednesday, March 8, 2023 6:03:56 PM

To the Board of Land and Natural Resources,

I am in full **support** of all of the conservation actions being proposed by DOFAW and DLNR to protect endangered Hawaiian Honeycreepers including captive breeding and mosquito population control. I strenuously encourage you to approve of their recommendations and allow these programs to move forward.

Many thanks,
Cody Lane

From: Valerie Lasciak
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Bio engineered mosquitoes
Date: Wednesday, March 8, 2023 6:05:43 PM

It is criminal to release billions mosquitoes with improper testing is criminal negligence!! I care about the native birds but not enough to endanger the residents of Maui with an untested solution

Valerie Lasciak
515 Liholiho St
Apt 2
Wailuku, Hi 96793
Sent from my iPhone

From: Jessica Lau
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written Testimony in Support of Agenda Item C-2
Date: Thursday, March 9, 2023 8:03:15 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I, Jessica Lau am in **support of Agenda Item C-2**, which would provide funding and support for the use of the Incompatible Insect Technique (IIT) by the Birds, Not Mosquitoes nonprofit collaboration to control the mosquito population and protect our manu (i.e. honeycreepers) which hold cultural and ecological importance.

I have recently learned that our honeycreepers have at least two years until extinction. These honeycreepers support not only our ecosystem but also sustain and replenish our local water sources. We have seen the importance of our water systems with the Red Hill water contamination and the importance of our cultural and historical values through the Thirty-Meter Telescope protests. However, our honeycreepers continue to be threatened by avian malaria and the impacts of climate change. We need to act with urgency.

Fortunately, IIT alters the breeding capabilities of mosquitoes safely, without endangerment of the health of people, land, and resources. Used in more than 10 places around the world, the technique allows communities to support their ecologically and culturally important species and control the mosquito population. I hope that you will consider this bill and recognize the importance of the manu, the people, and the land that we call home. Mahalo for your consideration.

Mahalo nui!
Jessica Lau

--

University of Hawai'i at Mānoa
Jessica Lau, Fourth-Year Undergraduate
BA Psychology (PSY) and BS Human Development and Family Studies (HDFS) Candidate
Mānoa Scholars Club | *Senate*
Project KUALIMA | *Project Coordinator*

From: Tayvia Lawrence
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL]
Date: Wednesday, March 8, 2023 1:12:15 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: Loree Searcy
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] I am opposed to C2
Date: Tuesday, March 7, 2023 4:48:09 PM

I do not want to see GMO mosquitoes released into Hawaii as the long term environmental effects and the effects on the human race are not known.
Please perform an EIS study to further evaluate!
I oppose c2.
Mahalo,
Loree Searcy

Sent from my iPhone

From:	Amanda Lee
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 9:32:35 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Sent from my iPhone

From: Tammy Lee
To: DLNR.BLNR.Testimony
Date: Tuesday, March 7, 2023 11:17:10 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of Wolbachia bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: Marlies Lee
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Mosquitoes
Date: Sunday, March 5, 2023 9:29:16 PM

Aloha,
I don’t hear people complaining about mosquitoes here on the islands!
So why use our islands as a test location for man-ipulated mosquitoes?
I say NO to this experiment!
No more testing on our Islands!

Keep our islands organic! Grow organic food! Become independent!

Mahalo
Marlies Lee

Sent from my iPad

From: Emily Leucht
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 9:00:32 AM

Dear Char Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2.

Native Hawaiian Honeycreepers are vital to our native ecosystems and to the native cultural of Hawai'i. I worked in native ecosystem education and outreach and watershed restoration for over ten years. At the moment these precious birds have a small safe haven in the high elevation forests where the mosquito population cannot survive. With climate change this too will change leaving these forests warmer and also raise the "mosquito line" leaving the birds vulnerable to diseases that are transmitted by these mosquitoes.

These birds are not only key to pollination of native trees like the ʻōhiʻa, they are also part of the cultural identity of the Hawaiian culture, mentioned and recorded in mele, kaʻao, and moʻolelo.

The conservation measures laid out in Agenda Item C-2 are our best bet in saving these amazing creatures for generations to come. I urge you to support the mosquito control laid out in item C-2. Please do what you can so that my keiki can show their mo'opuna these unique birds one day.

Mahalo nui for the opportunity to provide testimony,

Emily Leucht

From:	Tina Lia
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Testimony
Date:	Tuesday, March 7, 2023 11:44:48 AM
Attachments:	Wolbachia infection in wild mosquitoes (Diptera Culicidae) Singapore.pdf Wolbachia Can Enhance Plasmodium Infection in Mosquitoes Implications for Malaria Control.pdf EPA-HQ-OPP-2022-0896-0002_content.pdf

RE: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito release strategy for population control. The State of Hawaii and its multi-agency partnership *Birds, Not Mosquitoes* plan to release up to 775,992,000 biopesticide lab-reared *Wolbachia* bacteria-infected mosquitoes per week on Maui.[1] This mosquito experiment is an effort to save endangered native birds from avian malaria. Federal documentation confirms that the outcome is unknown and that this plan may not even work for its intended purpose.[2] This specific mosquito control technique has NEVER been done in the state of Hawaii.

This project would continue for at least 20 years and could go on indefinitely until the state finds another solution. The primary release method would be by drones, with additional releases by helicopter and ground methods. Mosquitoes would be released throughout the 64,666-acre project area at up to 134 drone flights per week, causing viewscape impacts and noise disturbances to forest bird breeding and nesting. The project would have significant environmental consequences, including impacts to the untrammeled, natural qualities of the wilderness character.[1]

Treatments of up to 6,000 mosquitoes per acre would occur up to twice per week – potentially over 40 BILLION invasive biopesticide mosquitoes released per year just on the island of Maui! These mosquitoes would be released in biodegradable packages that would litter the canopy and forest floor for as long as they remain in the environment.[1]

Landscape level control of *Culex* mosquitoes using this Incompatible Insect Technique (IIT) has never been done before. Even with *Aedes* mosquitoes, the largest project area was 724 acres.[3] Federal documentation connected to this project confirm that “although used world-wide for human health, *Wolbachia* IIT is a novel tool for conservation purposes and its degree of efficacy in remote forest landscapes is unknown.”[2] Additionally, the species planned for use in this project, *Culex quinquefasciatus*, has never been used for IIT.[3]

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria[4] and West Nile virus (bird and human)[5]. While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health. Tropical

disease expert Dr. Lorrin Pang (private citizen) has expressed concerns about horizontal transmission of the lab bacteria to wild mosquitoes and other insect vectors of disease, stating: “Hawaii has a bad history of invasive species entering and spreading unabated, including their spread of infectious diseases.” He asks, “How is this supposed to be self-contained?”[6]

Scientific studies document the risks of horizontal transmission[7,8,9], increased pathogen infection[4], evolutionary events[7], population replacement[10], and accidental release of females (who bite and breed)[10]. Biopesticide mosquitoes for this project originate from Palmyra Atoll.[3] *Wolbachia* bacteria for the project originates from Kuala Lumpur in Malaysia.[3] At least one strain of *Wolbachia* planned for import in connection with the project does not exist on these islands.[11] Once this plan starts, it is irreversible.

Accidental release of lab-bred females has not been addressed at all in the Environmental Assessment. When this IIT technique was used in Singapore, accidental female release led to population establishment, even with an Artificial Intelligence (AI) sex-sorting pipeline in place.[10] Attempts to mitigate population establishment with radiation, as was done in the Singapore study, are not even proposed for use here in Hawaii.[1]

An Environmental Risk Assessment for this biopesticide has not been conducted by the EPA, and the Hawaii Department of Agriculture has applied for an EPA Emergency Exemption for use of the mosquitoes without going through regulatory safety processes.[3]

This plan is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown. Who will take responsibility if something goes wrong – the federal government, the State of Hawaii, steering committee partners, private landowners? Adequate studies and research have not been conducted; and safer, less experimental alternatives have not been considered. Conflicts of interest have not been disclosed or addressed, and the state is rushing forward with this project without the consent of the people of these islands.

Public testimony has shown overwhelming opposition to these mosquito releases. We do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). We’re calling for a halt to this project. The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

We demand an Environmental Impact Statement (EIS) for the proposed "Suppression of Non-native Wild Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui." Please see our petition, currently at over 1,200 signatures and counting[12]. We have yet to receive a response from any of the decision makers.

Further, per HRS §171-4 (d)[13], BLNR Chair Dawn N.S. Chang and Board Member Vernon Char must recuse themselves from participating in any discussion or voting in this matter, given that they have clear conflicts of interest:

> HRS §171-4 (d) Each member shall disclose and file with the board a list of all transactions with the department of land and natural resources in which the member has a direct interest. The member shall also disclose all transactions with the department involving any corporation, association, partnership, or joint venture in which the member is an officer, partner, or employee. Any member having any interest, direct or indirect, in any matter before the board shall disqualify oneself from voting on or participating in the discussion of the matter.

Dawn N.S. Chang's Financial Disclosure, filed 1/2/23, states her employment as Chairperson of the State of Hawaii Department of Land and Natural Resources[14], a lead agency in the *Birds, Not Mosquitoes* partnership managing the biopesticide mosquito project. Vernon Char's Financial Disclosure, filed 6/1/22, states his employer as Char Sakamoto Ishii Lum & Ching Attorneys at Law[15], a practice whose clients include The Nature Conservancy[16], another lead partner in the biopesticide mosquito project. For precedent, please see former BLNR Chair Suzanne Case's recusal from voting on the import and listing agenda items for this project at the 6/28/22 Board of Agriculture meeting.[17]

Mahalo,
Tina Lia
Founder & President
Hawaii Unites
HawaiiUnites.org

REFERENCES:

1. Suppression of Non-native Wild Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui (12/8/22)
https://files.hawaii.gov/dbedt/erp/Doc_Library/2022-12-08-MA-DEA-Suppression-of-Mosquitoes-on-East-Maui.pdf

2. U.S. Department of the Interior Strategy for Preventing the Extinction of Hawaiian Forest Birds
https://www.fws.gov/sites/default/files/documents/DOI%20Strategy%20for%20Preventing%20the%20Extinction%20of%20Hawaiian%20Forest%20Birds%20%28508%29.pdf

3. HDOA EPA Application for Emergency Exemption
https://hawaiiunites.org/wp-content/uploads/2023/02/EPA-HQ-OPP-2022-0896-0002_content.pdf
https://www.regulations.gov/document/EPA-HQ-OPP-2022-0896-0002

4. "Wolbachia Can Enhance Plasmodium Infection in Mosquitoes: Implications for Malaria Control?" – Grant L. Hughes, Ana Rivero, Jason L. Rasgon (PLOS Pathogens, 9/4/14)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4154766/

5. "Wolbachia Enhances West Nile Virus (WNV) Infection in the Mosquito Culex tarsalis" – Brittany L. Dodson, Grant L. Hughes, Oluwatobi Paul, Amy C. Matacchiero, Laura D. Kramer, Jason L. Rasgon (PLOS Neglected Tropical Diseases, 7/10/14)
https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0002965

6. Wolbachia Mosquitoes in Hawaii: Unsettled Science (Part 2) (7/21/22)
https://mailchi.mp/12fb7ffe5f31/saturday-song-circle-in-paia-12pm-2pm-15015381

7. "Wolbachia infection in wild mosquitoes (Diptera: Culicidae): implications for transmission modes and host-endosymbiont associations in Singapore" – Huicong Ding, Huiqing Yeo, Nalini Puniamoorthy (BMC, 12/9/20)
https://parasitesandvectors.biomedcentral.com/articles/10.1186/s13071-020-04466-8

8. "Wolbachia Horizontal Transmission Events in Ants: What Do We Know and What Can We Learn?" – Sarah J. A. Tolley, Peter Nonacs, Panagiotis Sapountzis (Frontiers in Microbiology, 03/06/19)
https://www.frontiersin.org/articles/10.3389/fmicb.2019.00296/full

9. "The Intracellular Bacterium Wolbachia Uses Parasitoid Wasps as Phoretic Vectors for Efficient Horizontal Transmission" – Muhammad Z. Ahmed, Shao-Jian Li, Xia Xue, Xiang-Jie Yin, Shun-Xiang Ren, Francis M. Jiggins, Jaco M. Greeff, Bao-Li Qiu (National Center for Biotechnology Information, National Library of Medicine, 02/12/15)
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4347858/

10. "Wolbachia-mediated sterility suppresses Aedes aegypti populations in the urban tropics" – The Project Wolbachia – Singapore Consortium, Ng Lee Ching (medRxiv, 6/17/21)
https://www.medrxiv.org/content/10.1101/2021.06.16.21257922v1.full

11. HDOA Request to Import Southern House Mosquitoes for Immediate Field Release (6/9/22)
https://hdoa.hawaii.gov/wp-content/uploads/2018/05/DLNR-Culex-quinquefasciatus-PA-All-Docs.pdf

12. Petition: "Demand an Environmental Impact Statement for the Experimental Mosquito Release on Maui"
https://www.change.org/Maui_Mosquito_Experiment_EIS

13. Hawaii Revised Statutes HRS §171-4
https://www.capitol.hawaii.gov/hrscurrent/vol03_ch0121-0200d/HRS0171/HRS_0171-0004.htm

14. Dawn N.S. Chang Financial Disclosure filed 1/2/23
https://hawaiiethics.my.site.com/public/s/hsecm-fd-public/a0i6R00000Y0Yv4QAF/fd2023010909

15. Vernon Char Financial Disclosure filed 6/1/22
https://hawaiiethics.my.site.com/public/s/hsecm-fd-public/a0i6R00000TQdsNQAT/fd2022010431

16. Char Sakamoto Ishii Lum & Ching Attorneys at Law (Present and Former Clients: The

Nature Conservancy)
http://lawcsilc.com/Clients.html

17. Hawaii Board of Agriculture Meeting 6/28/22
https://hdoa.hawaii.gov/wp-content/uploads/2022/09/2022-06-28-BOA-Minutes-Final.pdf
https://www.youtube.com/watch?v=Y4QAqlH5G0U&t=10557s

Request for Exemption of Federal and State Agencies for Use of a Pesticide Under Emergency Conditions

Section 18 of FIFRA Specific Exemption

Department of Agriculture
STATE OF HAWAII

1428 South King St.
Honolulu, Hawaii 96814

DQB Males
Wolbachia pipientis*, wAlbB, contained in live adult male *Culex quinquefasciatus
EPA Reg. No. PENDING

To Control Mosquitos (*Culex quinquefasciatus*), the vector of avian malaria, for Conservation Purposes in Hawaii

with registrant Verily Life Sciences LLC

OCTOBER, 28, 2022

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Attachment D: Verily letter of support
Attachment E: Other supporting documents including references for DQB Confidential Statement of Formula, and manufacturing process MRID - 51991801
Attachment F: References
Attachment G: Convenience copies of select publications

2022 FIFRA Section 18 Specific Exemption for DQB Males in Hawaii

General information requirements of §40 CFR 166.20(a) in an application for a Specific Exemption

TYPE OF EXEMPTION BEING REQUESTED
✓ SPECIFIC
QUARANTINE
PUBLIC HEALTH

SECTION 166.20(a)(1): CONTACT PERSON(S) AND QUALIFIED EXPERTS

i. This application is to the Administrator of the Environmental Protection Agency (EPA) for a Specific Exemption to authorize the use of *Wolbachia pipientis*, wAlbB , contained in live adult male *Culex quinquefasciatus* (DQB Males, EPA Registration Number is pending) to control mosquitos (*C. quinquefasciatus*), the vector of avian malaria, for conservation uses in Hawaii by the Hawaii Department of Agriculture (HDOA). Any questions related to this request should be addressed to:

Esther Riechert
State of Hawaii
Department of Agriculture
Pesticides Branch
1428 South King Street
Honolulu, HI 96814
Phone: (808) 973-9403
Email: esther.riechert@hawaii.gov

Greg Takeshima
State of Hawaii
Department of Agriculture
Pesticides Branch
1428 South King Street
Honolulu, HI 96814
Phone: (808)-973-9402

Email: greg.y.takeshima@hawaii.gov

ii. The following qualified experts are available to answer questions:

United States Fish and Wildlife Service(s)(USFWS):

Adam E. Vorsino, PhD
Ecologist
Strategic Habitat Conservation Program
Pacific Islands Fish and Wildlife Office
United States Fish and Wildlife Service
300 Ala Moana Blvd, Ste. 3-122
Honolulu, HI, 96850
Phone: (808)792-9431
Email: adam_vorsino@fws.gov

Hawaii Department of Land and Natural Resource(s)(DLNR):

Cynthia B.A. King
Entomologist
Division of Forestry and Wildlife
Native Ecosystem Protection and Management, Hawaii Invertebrate Program
1151 Punchbowl Street, Rm. 325
Honolulu, HI 96813
Office: 587-0019
Email: cynthia.b.king@hawaii.gov

Registrant Representative(s):

Nigel Snoad, PhD
Product Manager
Verily Life Sciences LLC
269 E. Grand Avenue
South San Francisco, CA 94080
Phone: (718) 635-3644
Email: nigelsnoad@verily.com

Sara N. Mitchell, PhD
Senior Scientist
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269 E. Grand Avenue
South San Francisco, CA 94080
Phone: 415 736 5034
Email: snmitchell@verily.com

SECTION 166.20(a)(2): DESCRIPTION OF PESTICIDE REQUESTED

- **Common Chemical Name (Active Ingredients):** *Wolbachia pipientis*, wAlbB (DQB strain)

- **Trade Name:** DQB Males
  EPA Reg. No.: Unregistered

- **Confidential Statement of Formula:** Attached to this submission

- **Formulation:**
  wAlbB contained in live adult male *Culex quinquefasciatus* mosquitoes (DQB strain) active ingredient < 0.3%*
  *percent (w/w) of adult male mosquitoes

- **Mosquito and Wolbachia source:**

The DQB line of mosquitoes was developed through transfection of *Wolbachia pipientis* wAlb*B* isolated from *Ae. albopictus* KLP strain mosquitoes originating from Kuala Lumpur, Malaysia into *Culex quinquefasciatus* Palmyra strain mosquitoes originating from Palmyra Atoll. Prior to transfection, the naturally occurring wPip infection was removed from the Palmyra strain through antibiotic treatment using tetracycline and rifampicin as described in Pike & Kingcombe 2009 following the feeding protocol outlined in Dobson and Rattanadechakul 2001. Methods for DQB line generation are substantively similar to those outlined in MRID 51788911 with non-significant changes to account for Culex egg morphology. The DQB line was not created using genetic modification and the mosquitoes are not genetically modified organisms.

Table 1. Taxonomic designation of the *Wolbachia* present in the DAB line of *Ae. aegypti.*

Kingdom	Bacteria
Phylum	Proteobacteria
Class	Alphaproteobacteria
Order	Rickettsiales
Family	Rickettsiaceae
Genus	*Wolbachia*
Species	Pipientis
Clade	Supergroup: B
Strain	DQB: (**D**ebug) (*Culex* ***q****uinquefasciatus*) (wAlb**B**) DQB contains

	wAlbB *Wolbachia* isolated from *Aedes albopictus* originating from Kuala Lumpur, Malaysia (KLP strain).

Prior to release of the DQB strain on Hawai'i, the original line of mosquitoes (Palmyra mosquito genetic background) will be backcrossed into a locally appropriate *Culex quinquefasciatus* strain mosquitoes (from Maui or Kauai) cleared of wPip as outlined above. Wolbachia phenotypes pertinent to incompatible male releases (cytoplasmic incompatibility, maternal transmission), are not affected by mosquito genetic background as exemplified by the use of the WB1 and WB2 strains of wAlbB Wolbachia in *Ae. aegypti* of different geographical origins in published IIT trials (Mains *et al.* 2019 [WB1 in Florida strain], Crawford *et al*. 2020 [WB1 in a Fresno-Clovis strain], Beebe e*t al.* 2021[WB2 in Innisfail strain], Ng *et al.* 2021 [WB2 in Singapore strain]).

Backcross and QC protocols on backcrossed lines are detailed in the DQB males manufacturing process (MRID 51991801).

SECTION 166.20(a)(3): DESCRIPTION OF PROPOSED USE

i. **Sites to be Treated:** State, Federal and Private wildlife conservation areas that contain *Cx. quinquefasciatus* mosquitoes throughout the State of Hawaii.

ii. **Method of Application:** Point releases by hand or aerial releases.

iii. Rate of Application: Initial absolute rates of release are at least 150 males/acre/week, which may be adjusted upwards or downwards after a Mark Release Recapture in the proposed treatment area as this will establish baseline mosquito populations in the treatment area and the ecology, field longevity and other factors used to estimate release rates (number of males/acre/week) sufficient to achieve and maintaining the "overflooding ratio" of ≥ 10:1 DQB males:wild type (WT) male *Cx. quinquefasciatus* in adult traps in the release area as described on the DQB label. If wild type populations are significantly suppressed release rates may be lowered while still achieving ≥ 10:1 overflooding DQB:WT males.

We estimate that ~150 males/acre/week will be required as an initial minimum release rates for effective suppression (see Attachment B) based on published data of female *Cx.*

quinq. populations in Hawaiian forest reserves. Trapping data in treatment areas or appropriate proxy locations will be used to adjust release rates upwards or downwards as required to maintain an overflooding of 10:1 DQB males:WT males and/or to compensate for higher levels of WT Cx. quinq.

A program will be set up by DLNR and USFWS to monitor mosquito populations throughout the year in treatment sites. Samples of collected mosquitoes will undergo molecular testing (using methods similar to those outlined in Crawford et al. 2020) to differentiate recaptured *w*AlbB DQB males from Wild Type males and to estimate the overflooding ratio across and within the treatment area. The frequency and distribution of collections and molecular testing will be included in the monitoring program plan, and may be adjusted throughout the treatment program so as to adequately sample the treatment site, and identify seasonal variations.

iv. **Maximum Number of Applications:** *156 applications per release site per year based on an anticipated maximum of 3 releases per week.* At every treatment location release may be for up to a year, with the intention of having multiple releases per week. If strong suppression is achieved releases may be reduced in frequency at a given location with releases starting at a new location at the same cadence. Thus the total number of application days is up to 3x52 = 156 during the year. If the permit is extended then a similar rate of releases is expected to occur.

v. **Total Acreage to be Treated:** Up to 20,000 acres of State, Federal and Private wildlife conservation areas in the State of Hawaii. The actual treatment area will be determined by DLNR and USFWS based on conservation priorities, access logistics and the supply of mosquitoes available.

No State lands under the authority of the Department of Hawaiian Homelands will be included in proposed locations from which mosquitoes will be released (treatment areas).

vi. **Total Amount of Pesticide to be Used:**

Maximum amount of DQB Males to be applied per year: Up to 3,000,000 males per week = 156,000,000 males/year.

Maximum amount of *Wolbachia pipientis*, wAlbB to be applied per year: Up to ~1.83g/week = 95g/year

vii. Restrictions and Requirements Concerning the Proposed Use ~~(not on labeling)~~

- HDOA Plant Quarantine Branch added *Cx. quinquefasciatus* to the List of Restricted Animals (Part A) allowing for inoculated male mosquitoes to be imported into the State of Hawaii. As such, an import permit from the Plant Quarantine Branch must be obtained prior to importation.

- A microbial permit for *Wolbachia pipientis* will be required from HDOA Plant Quarantine Branch prior to importation.

- Applicators are required to notify the HDOA Pesticides Branch at least seven (7) days prior to application, this may be done via a weekly or monthly schedule. Notification information must include the name of the applicator(s), employer's name, phone number, e-mail address (if applicable), location via address, GPS coordinates, or Tax Map Key (TMP), estimated amount of mosquitos to be released, and estimated date of application. Notifications will be-submitted via email to: HDOA.Sec18@hawaii.gov or via mail to Hawaii Department of Agriculture Pesticides Branch, 1428 S. King Street, Honolulu, HI 96814.

- Applicators are required to keep records of each application. A weekly cumulative report may be submitted for each treatment area. Use records will be recorded on forms provided by the HDOA Pesticides Branch and signed or signed electronically. These records must be submitted to the Branch within sixteen (16) days following each application or following the last weekly application. Records of application must be submitted via email to: HDOA.Sec18@hawaii.gov or via mail to Hawaii Department of Agriculture Pesticides Branch, 1428 S. King Street, Honolulu, HI 96814.

- Applicators agree to be subject to at least one pesticide inspection for Section 18 Exemption use.

- Current mosquito population status of WT *Cx. quinquefasciatus.* and released DQB males along with overflooding will be determined by the monitoring program set up by DLNR and USFWS and the Pesticides Branch will be informed of how the monitoring program will operate including frequency of sampling and the frequency and volume of molecular testing.

- Any adverse effects resulting from the use of DQB Males under this emergency exemption must be immediately reported to the HDOAPesticides Branch at 808-973-9402.

viii. **Duration of the Proposed Use:**

One year, beginning from the date of issue of the Specific Emergency Exemption.

Applications of DQB Males are expected throughout the year.

Mosquitoes in Hawaii breed throughout the year due to Hawaii's warm climate.

ix. **Earliest Possible Harvest Date:**

Not applicable to this application.

x. **Restrictions and Requirements:**

- The sites to be treated are conservation areas that have known populations of *Culex quinquefasciatus.*
- This product is for use only for conservation agencies and their designated representatives.
- The target pest is the wild type mosquito (*Culex quinquefasciatus*).
- DQB Males must be applied as soon as possible, at least within 72 hours of receipt.
- DQB Males will be applied at a rate of up to 3,000,000 males per week (up to ~1.83g /week) at a ≥ 10:1 overflooding ratio of DQB males:WT *Cx. quinquefasciatus* males.

SECTION 166.20(a)(4): ALTERNATIVE METHODS OF CONTROL

Several organizations including USFWS, NPS, University of Hawaii, and HDOA have spent the past 7 years reviewing various vector control options and methods for direct control of Avian Malaria. None of these methods meet the requirements of potential efficacy, operational feasibility and appropriateness for use in a conservation area.

i. Registered Alternative Pesticides ("Emergency Status and Alternative Considered, 2022) :

Area-wide application of conventional pesticide products

1. At least six conventional pesticide spray formulations are registered in Hawaii and labeled for control of mosquitoes in non-agricultural areas, however none of the products are labeled for use against mosquitoes in conservation areas, forests, bogs or waterways. Two products, Sevin© Brand XLR Plus Carbaryl Insecticide and Sevin© RP4 Carbaryl Insecticide contain the active ingredient Carbaryl. The other four products, Fyfanon© ULV Mosquito Insecticide, Fyfanon© 57% EC, Fyfanon© EW Insecticide and Malathion 5EC© contain Malathion.

2. The use of pesticide products containing Carbaryl, Malathion or other active ingredients with modes of action known to impact arthropods are unacceptable for application in natural areas due to the presence of endemic and rare native arthropod species in the areas proposed for application. There are over 1400 described arthropod species which are endemic to the island of Kauai and over 1700 described arthropods endemic to the island of Maui. The natural areas which serve as the last refuges for the native forest birds also support a diversity of the remaining endemic arthropods, including federally listed endangered and threatened species.

a. Fourteen Hawaiian picture wing flies (*Drosophilia sp.*), are listed as endangered by USFWS. These species are endemic to the Hawaiian islands, and many are found primarily in upper elevation montane rainforests; the refugia of native Hawaiian forest birds and the proposed treatment area.
    i. Examples:
        1. *Drosophila musaphilia*: Endemic to the island of Kauai. Its host plant, Acacia koa, is fairly common and stable within, and surrounding, its known range on Kauai. Critical habitat currently identified on Kauai: Kokee (794,321 acres within the proposed application area)
        2. *Drosophila neoclavisetae*: endemic to the island of Maui. Host plants are reported to be from Cyanea sp. and occur in native, upper elevation montane rainforests, within the proposed application area.
        3. *Drosophila ochrobasis*: is endemic to mesic and wet montane habitats on the island of Hawaii, within the proposed application area.

b. Six Hawaiian damselflies (*Megalagrion sp.*) are listed as endangered by USFWS. These species are endemic to the Hawaiian islands, and while none are extant in the proposed treatment areas, their reliance on aquatic habitat/streams/surface habitat with connectivity in the project areas would preclude application of chemical insecticides due to risk of non-target pesticide drift and run-off.
    i. Examples:
        1. Flying earwig Hawaiian damselfly (*Megalagrion nesiotes*): Terrestrial or semi-terrestrial naiads may occur in damp leaf litter, moist leaf axils of plants up to several feet above ground, or within moist soil or seeps between boulders in suitable habitat. Primarily occurs on Maui Nui.
        2. Pacific Hawaiian damselfly (*Megalagrion pacificum*): Pacific Hawaiian damselflies are now believed to be limited to the islands of Maui and Molokai and one population found in 1998 on Hawaii island.

c. Blackburn's sphinx moth (*Manduca blackburni*): is listed as endangered by USFWS. It is Hawaii's largest native insect, with a wing span of up to 5 inches (12 centimeters). It was originally found throughout the Hawaiian islands, but is now restricted to populations on Maui Nui and Hawaii (Big Island). It was originally found from sea level to 5000 ft.

3. Potential for non-target impacts on other insects and therefore birds

a. These upper elevation forest bird refugia are the most pristine native Hawaiian rainforests currently in existence. They host a myriad of native insect species that are critical to the ecosystem in which the native forest birds exist/thrive, and as food sources to the native forest birds.
    i. Examples
        1. Maui creeper (Maui ‘alauahio) (*Paroreomyza montana*): Insectivore endemic to Maui Nui. Occurs above 900 meters.
        2. crested honeycreeper (Akohekohe) (Palmeria dolei): nectarivorous, and insectivorous endemic to Maui Nui. Occur primarily above 1,100 meters.
        3. Kauai akialoa (honeycreeper) (*Akialoa stejnegeri*): nectarivorous, and opportunistic insectivore endemic to Kauai. Occurred throughout the islands.
        4. `I`iwi (*Drepanis coccinea*): `I`iwi are widely recognized as one of the most spectacular and iconic of the extant Hawaiian forest birds. They are nectarivorous,and opportunistic insectivores endemic to all major Hawaiian islands, but relegated to Hawaii, Kauai and Maui.
        5. ‘Apapane (*Himatione sanguinea*): Small, crimson and primarily nectarivorous honeycreeper that occurs in upper elevation forests (above 1,250 meters) on all major Hawaiian islands.

4. The remote native montane rainforest refugia of endemic Hawaiian forest birds are inaccessible and challenging to operate in. Locating specific larval mosquito habitat across this remote and challenging terrain is extremely difficult due to both the structure and slope of the forest. Larval habitat occurs throughout the montane rainforest in tree fern cavities and the rock holes and pools of intermittent stream beds. Also, the extensive rainfall causes swamping of many possible standing water sites, reducing the ability to locate cryptic standing water sources as well as decreasing the efficacy of chemical applications.
5. Insects can develop resistance to chemical insecticides
6. Chemicals can run-off into waterways, and the area proposed for application is within Kauai and Maui watersheds. https://www.hawaiiwatershedatlas.com/watersheds/kauai/24004.pdf))
    a. Could impact groundwater/drinking water resources.
    b. Stream invertebrates and freshwater fish
    c. Downstream impacts on marine invertebrates/systems

Broadcast constrained larvicide products

7. There are at least 13 products registered in Hawaii and labeled for control of mosquitoes in the larval stage. VectoBac Primary Powder©, VectoBac DT Biological Larvicide©,

VectoBac G Biological Larvicide Granules©, VectoBac 12AS Aqueous Suspension Biological Larvicide©, Bonide Mosquito Beater WSP© and MosquitoDunks© contain the active ingredient Bacillus thuringiensis israelensis (Bti). VectoMax FG Biological Larvicide©, Gnatrol WDG Biological Larvicide, and Terro No Mess Mosquito Larvicide Pouches© contain Bti and Bacillus sphaericus (Bs). VectoLex WSP Biological Larvicide©, VectoLex FG Biological Larvicide©, VectoLex WDG Biological Larvicide©, which contain Bs. Two products, Metalarv S-PT Mosquito Growth Regulator Spherical Pellets© and Metalarv XRP Mosquito Growth Regulator Extended Release Pouch© contain insect growth regulator (S)-Methoprene as the active ingredient.

8. The broadcast constrained biopesticides and growth regulators are unlikely to achieve the level of larval suppression needed in rainforests aquatic habitat given the significant rainfall the rainforests on Maui and Kauai receive.
9. Biopesticides Bti and Bs have poor efficacy in controlling later instar larvae.
    a. Biopesticides and growth regulators are unlikely to effectively treat areas with high canopy, or cryptic standing water/larval breeding sites using an aerial broadcast strategy in conservation areas.
    b. Remote, isolated, and treacherous terrain definitive of these native Hawaiian rainforests makes it virtually impossible to treat cryptic Culicid larval habitat using hand or even aerial broadcast techniques in conservation areas.

Other products considered

10. According to the Hawaii Department of Agriculture, Pesticides Branch there are currently 1,621 products registered in Hawaii which contain language on the label indicating their application has an adverse impact on mosquitoes or the sites listed are not applicable to conservation areas.
        i. Of the products available, 1,521 are miticides, disinfectants, repellants, feeding depressants, sunscreens, or products for pets and/or areas with domesticated livestock. The remaining products are general insecticides (sprays, drenches, foggers or termiticides) for control of ants, roaches, bedbugs, spiders, scorpions, dust mites, lice, biting flies, etc. for interior of commercial or residential structures, exterior barriers to structures, lawns, gardens, stables, greenhouses and golf courses.

Biological control using Toxorhynchites sp. mosquitoes

11. Multiple species in the state: *T. brevipalpi, T. theobaldi*
12. Released in 1929 and again in 1950 to control Aedes sp.
13. These biological control agents are present across the state and are not effective in suppressing mosquito populations.

Ungulate removal and control

14. In studies of native forest plots where feral ungulates (including pigs) were removed by trapping and other methods, researchers have demonstrated a correlation in the abundance of *Culex spp.* mosquitoes when comparing pigfree, fenced areas to adjacent sites where feral pig activity is unmanaged (Hess et al. 2006).
15. Management of feral pigs may be strategic to managing avian malaria and pox, particularly in remote Hawaiian rain forests where studies have documented that habitats created by pigs are the most abundant and productive habitat for larval mosquitoes (USGS 2006).
16. The consequences of feral pig activities thus further exacerbate the impacts to iiwi from avian malaria and avian pox, by creating and enhancing larval habitats for the mosquito vector, thereby increasing exposure to these diseases.
17. The Hawai`i Department of Land and Natural Resources has maintained liberal public hunting seasons to minimize forest damage caused by feral pigs and goats within the Alaka`i Wilderness Preserve for several decades. Unfortunately, public hunting succeeds only in the more accessible areas of the preserve, and ungulate populations in more remote areas remain quite high.
18. Aerial reconnaissance and shooting of feral goats and pigs has been attempted in the most remote regions, but is not effective in inaccessible forest bird refugia.
19. Even in the absence of feral goats and pigs there would still be larval and breeding habitat available in these native rainforest refugia.
20. Management of feral ungulates is a part of any Integrated Pest Management strategy when managing Hawaii's native forest resources.

SECTION 166.20(a)(5): EFFECTIVENESS OF PROPOSED USE

Overview

The use of an Incompatible Insect Technique (IIT) by releasing male mosquitoes with a Wild Type incompatible *Wolbachia pipientis*, has been identified by Hawaiian conservation agencies and partners as the fastest environmentally appropriate option for suppressing Avian Malaria mosquito vectors in Hawaiian bird refugia at a landscape-scale. *Wolbachia pipientis* is a naturally occurring bacteria present in ~60% of arthropods, including many endemic to Hawaii, including *Aedes albopictus* mosquitoes (which is the source of the wAlbB strain in these DQB *C. quinquefasciatus*) and also in Hawaiian WT *C. quinquefasciatus* mosquitoes. When male mosquitoes carrying one strain of *Wolbachia pipientis* breed with other mosquitoes with a different strain of *Wolbachia pipientis*, they produce non-viable eggs leading to population

suppression.[1] The DQB line was not created using genetic modification and the mosquitoes are not genetically modified organisms.

Rationale for expected efficacy and label

The label for DQB males (wAlbB *Wolbachia pipientis* in male *C. quinquefasciatus*) states that:

- Releases of male mosquitoes are to be performed at least weekly at a suggested minimum initial treatment rate of 150 males/acre/week. Male mosquitoes are released to the air and fly away to mate with indigenous females. If multiple containers are used, mosquito releases should be distributed evenly over the treatment area with release points spaced <1 km apart to ensure consistent coverage within the treatment area. To ensure highest possible efficacy adhere to this regimen until the end of the mosquito season.
- Trapping data in treatment areas or appropriate proxy locations (as reviewed by the Hawaii Department of Land and Natural Resources) should be used to adjust release rates as required to maintain desired overflooding ratio of DQB:Wild type male *Cx. quinquefasciatus* of >10:1 and to compensate for estimated higher levels of *Cx. quinquefasciatus* in treatment areas as appropriate.
- Overflooding ratio is determined by comparing the pre- and post-release average male trap counts in treatment areas or by using molecular methods on males sampled from treatment areas (to differentiate wAlbB males from Wild Type see Crawford et al 2020 for similar methods). For treatment areas inaccessible for regular trapping the Hawaii Department of Agriculture may approve appropriate proxies.

We estimate (see Attachment B) a minimum effective release rate for DQB males into primary endangered Hawaiian bird forest refugia to be 150 males/acre/week. Trapping data in treatment areas or appropriate proxy locations (as determined by DLNR and USFWS) will be used to adjust release rates as required to maintain an overflooding of 10:1 DQB males:WT males and to compensate for higher levels of WT *Cx. quinquefasciatus* as necessary.

These release strategies and overflooding rates are in line with published studies with successful suppression results from incompatible male *Culex* and *Aedes Wolbachia pipientis* programs (IIT programs, see Table 2 below), and are supported for DQB males QC assays demonstrating that DQB males possess the phenotypic properties required for a successful IIT suppression program. We note that while we provide, as required, a minimum application rate, the application rate is best calculated as that required to achieve a ratio to the wild type so that incompatible matings outnumber compatible matings, leading to population suppression, as the rate of wAlbB males per week per acre will vary because of the variability of wild-type mosquito populations in the treatment areas (conservation areas).

We outline below the pesticidal mode of action, and summarize data and field studies that demonstrate successful Wild Type mosquito suppression when overflooding is achieved with healthy incompatible male mosquitoes. More details are presented in Table 1 and other documents submitted along with this application (Attachment E, including the manufacturing process outlining quality controls.)

[1] USFWS Information Memorandum. March 26, 2021. "Preventing Extinction of Hawaii's Endangered Forest Birds through Landscape-Scale Mosquito Control"

Mode of action and phenotype of *Wolbachia pipientis* active ingredient is equivalent for DQB wAlbB in *C. quinquefasciatus* and published wAlbB in *Aedes aegypti* field studies.

The modes of action for incompatible *Wolbachia pipientis* use as a pesticide in *Culex* and *Aedes* mosquitoes are the same: sustained high levels of incompatible matings by incompatible *Wolbachia*-males leads to fewer viable offspring by WT females and each succeeding generation of WT mosquitoes will be smaller, leading to population suppression of the WT population. This mode of action and the efficacy of male releases is a result of three factors, all of which are true for DQB as well as for published studies using other *w*AlbB strains in *Aedes* mosquitoes:

1. presence of *w*AlbB *Wolbachia* in released *w*AlbB *C. quinquefasciatus* males, which leads to demonstrated Cytoplasmic Incompatibility between released *w*AlbB males and WT *C. quinquefasciatus* females infected with *w*Pip *Wolbachia pipientis*
2. released wAlbB males are healthy leading to field survival and mating efficacy
3. sufficient, and appropriately located, released males to ensure that most matings of WT female mosquitoes are incompatible, leading to wild females laying eggs that do not hatch resulting in population decline of the target, and potentially disease-carrying mosquitoes.

This mode of action is identical to that of other incompatible *Wolbachia pipientis* male mosquito products including those already reviewed by the EPA (specifically WB1 and ZAP) and those used successfully internationally (e.g WB2 in Australia and Singapore). This mode of action is demonstrated by a limited number of key phenotypes and processes, all of which hold true for DQB and support the label claims. Table 1 (below) summarizes the phenotypes and requirements necessary for the mode of action of DQB males and outlines how the manufacturing process (MRID 51991801) ensures these standards are met.

Table 1. Phenotypes and requirements for DQB male mode of action.

Phenotype/Requirement	**DQB Quality Controls during manufacturing process (MRID 51991801)**	**Summary and Notes**
Presence of *w*AlbB in released males: • 100% maternal transmission of *w*AlbB • Confirmation of *w*AlbB presence in release batches	100% maternal transmission is confirmed in each strain of DQB developed DQB *w*AlbB colony QC is performed throughout	Regular sampling confirms maintenance of *w*AlbB in the *Cx. quin.* DQB colony.

	releases.	
Cytoplasmic Incompatibility of released males with WT females	Bidirectional CI is confirmed in each strain of DQB developed. Sufficiency (>90%)of bidirectional CI is confirmed using DQB strain for release and suitable wild type colonies.	Bidirectional CI testing is performed as part of standard QC after generation of new backcross lines. CI is also confirmed against wild type colonies from areas proposed for male releases.
Healthy released males (longevity)	Minimum 2 days median longevity of males at point of release.	Consistent with *w*AlbB in *Ae. aegypti* studies and WB1 EUP label. Note that the lab longevity of *Cx. quinquefasciatus* is lower than *Aedes aegypti*.
Minimal *w*AlbB female contamination	<1:250,000 female contaminants.	Consistent with WB1 and WB2 field studies, EUPs (89668-EUP-3) and labeling. Note that for EUP-89668-EUP-3 the WB1 manufacturing process of Verily was reviewed by EPA (EPA decision #525795 published as EPA-HQ-OPP-2017-0392-0004). This Verily QC process is substantively identical to that previously provided to EPA (e.g. MRID 51991801). As described in (Crawford et al 2020) Verily may optionally perform additional quality control checks including additional independent machine learning image reviews and human reviews which significantly further reduce female contamination in the released product. For DQB males these steps result in the expectation of a significantly lower rate during ongoing operations, estimated to be <1:2,000,000 and continually improved.
Sufficient males in the correct location	See proposed DQB label (Attachment A) for dosing and distribution methods in treatment area.	DQB Label is based on evidence from published studies showing suppression when *w*AlbB males are reared according to Verily's manufacturing method (or similar) and released according

		to the proposed DQB label (see Attachment A). Target is to achieve ratio of at least 10:1 DQB males to wild male so incompatible matings outnumber compatible matings.

Table 2 below contains a summary and references to published field studies with incompatible *Wolbachia pipientis* males that demonstrate the same pesticidal phenotypes and mode of action as that of DQB males. These studies are relevant data that establish field efficacy and safety of male incompatible *W. pipientis* in mosquitoes when reared using Verily's mosquito manufacturing process or an equivalent process. These data demonstrate that WB1 and WB2 wAlbB strains, and hence DQB releases, conducted in accordance with the proposed DQB label (≥10:1 incompatible:WT male) are sufficient to achieve effective suppression across a range of environments. We also include literature from a historical incompatible *Cx. pipiens* (noting that *Cx. quinquefasciatus* is a part of the *Cx. pipiens* species complex) field trial showing that the release of a sufficient quantity of incompatible male *Culex* can achieve suppression and local elimination.

Table 2. Timeline of published studies demonstrating field efficacy of Insect Incompatibility Technique using incompatible *Wolbachia* male releases in mosquitoes.

Year	Mosquito Species	*Wolbachia* Strain	Location	Summary	Reference
1967	*Culex pipiens fatigans*	*w*Pip	Okpo, Myanmar	Natural incompatibility of a French (Paris) strain of *Cx. pipiens* carrying *w*Pip was leveraged to control local population through daily releases of 5000 incompatible males over 12 weeks in 1967. During the 12th week, 100% inviable egg rafts were recorded. Overflooding rates were not recorded.	Laven 1967
2010	*Ae. polynesiensis*	B clade *Wolbachia* from *Aedes riversi*	Toamaro, Uninhabited 'motu' island, French Polynesia	Natural bidirectional incompatibility of *Ae. riversi Wolbachia* (Clade B) with wild *Ae. polynesiensis* carrying Clade A *Wolbachia* was exploited through introgression of *Ae. riversi* Clade B *Wolbachia* into *Ae. polynesiensis* background after antibiotic clearing, to create the released CP strain. 30 weeks of male releases across ~ 10 acres averaging 3,800 CP males/week resulted in ~20% reduction in egg hatch rate, attributed to CI. [~44% reduction in female trap counts]	O'Connor *et al.* 2012
2014	*Ae. albopictus*	*w*Pip	Lexington, Kentucky	A transfected strain of *Ae. albopictus* naturally cleared of wAlbA/B before wPip introduction was employed under EPA EUP in	Mains *et al.* 2016

				Lexington. 10,000 incompatible males per week were released over 17 weeks into a ~30 acre treatment site. Compared to an untreated control area, a peak female adult suppression of 66% suppression was recorded. Overflooding ratios were not recorded, though male trap counts in treatment areas were ~2x control areas.	
2015 - 2017	*Ae. albopictus*	*w*Pip	Guangzhou, China	Triple-*Wolbachia* infection employed with wPip transfected into *Ae. albopictus* strain naturally infected with wAlbA and wAlbB. Additional radiation treatment used to sterilize residual females to avoid population replacement through accidental female release. Yearly female adult reductions of 83%-100% recorded across two release sites (80 Acres) compared to three matched controls after three male releases per week (between 24.3k - 48.1k males per acre per week; male overflooding ratio of 9:1 to 16:1 Wb:WT male overflooding)	Zheng *et al.* 2019
2016	*Ae. aegypti*	*w*AlbA & *w*AlbB (ThAB)	Nong Satit, Thailand	Superinfected *Ae. aegypti* line generated with *w*AlbA and *w*AlbB infection. Before male releases, sex separated male pupae were irradiated to sterilize residual females and avoid population replacement through accidental female release. For 6 months, 10,000-25,000 males were released weekly into a 160 acre treatment site. Compared to control areas, an 84% reduction in hatch rate and 97.3% reduction in mean number of females trapped per household was recorded.	Kittayapong *et al.* 2019
2017 - 2018	*Ae. aegypti*	*w*AlbB (WB1)	Fresno, California	wAlbB transfected *Ae. aegypti* line (WB1) male releases resulted in >95% suppression of female *Ae. aegypti* population based on BG trap collections in 2018 season across three treatment sites (724 acres) compared to matched controls after daily releases of males at a minimum rate of 671 males/acre/week (48:1 Wb:WT male overflooding, achieved by starting releases prior to, and suppressing, mosquito population growth in treatment areas).	Crawford *et al.* 2020
2018	*Ae. aegypti*	*w*AlbB (WB1)	Miami, Florida	*w*AlbB transfected *Ae. aegypti* line (WB1) male releases for 6 months into 170 acres treatment site. Three to five releases per week were performed totalling 75,000-375,000 males per week. Post intervention, a maximum reduction in females of 78% was recorded when comparing the center of the release site to the control area.	Mains *et al.* 2019
2018	*Ae. aegypti*	*w*AlbB (WB2)	Innisfail, Australia	Males from *w*AlbB transfected *Ae. aegypti* line (WB2) backcrossed into local strain (wAlbB2-F4)were released across three treatment sites totalling 478 acres for 20 weeks at a rate of 75-161 males/acre/week (6:1 to 18:1 Wb:WT male overflooding ratio depending on treatment site, which resulted in 78-97% suppression based on female trap counts compared to three matched control areas.	Beebe *et al.* 2021
2019	*Ae. aegypti*	*w*AlbB (WB2)	Singapore	The WB2 wAlbB transfected *Ae. aegypti* line backcrossed into local Singapore strain was	Ng *et al.* 2021

				employed in releases over 3 years in high-rise apartments neighborhood (Yishun & Tampines) at ~1500 males/acre/wk and a Wb:WT male overflooding ratio of 30:1. Due to the high-rise nature of the landscape, acre estimates are inaccurate. Overall a 93-98% reduction in Ae. aegypti and 71-88% reduction in dengue incidence was recorded.	

SECTION 166.20(a)(6): DISCUSSION OF RESIDUES FOR FOOD USES

Not applicable to this application.

SECTION 166.20(a)(7): DISCUSSION OF RISK INFORMATION

Risks to Human Health

WoIbachia pipientis is an obligate intracellular bacterium, occurring naturally in many invertebrates as a part of their microbiome, including, insects, isopods, ticks and filarial worms of humans and other animals (Casiraghi et aI., 2005; Saridaki & Bourtzis 2010). *WoIbachia pipientis* is present in up to 65% of insect species (Hilgenboecker et al. 2008, Kittayapong et al. 2008, Ruang-Areerate et al. 2003.) including many mosquitoes, including both *Cx. quinquefasciatus* and other related mosquitoes in the *Culex pipiens* species complex, and *Aedes albopictus* (the source of the *Wolbachia pipientis* strain used in DQB males,) resulting in a long history of environmental exposure of humans to *Wolbachia pipientis* in mosquitoes.

The human health risks of male mosquitoes with incompatible *Wolbachia pipientis* have been reviewed by the EPA in the context of other products (see U.S. EPA 2017a, and U.S. EPA 2017c for example) and the Agency found "**negligible exposure to humans resulting in a negligible human health risk and therefore meets the standard of no unreasonable adverse effects.**" (U.S. EPA, 2017a)

Similar to previously published EPA reviews the rationale for applying this finding of negligible risks of harm to human or environmental health to DQB males is (in summary):

- For DQB male mosquito releases, exposure of humans to *Wolbachia pipientis* is extremely low as released male mosquitoes do not bite, do not vector disease, and do not survive for more than a few days in the wild.
- In the context of releases of DQB *Cx. quinquefasciatus* in Hawaiian forest reserves as a part of a bird conservation program, the human exposure will be even lower as there is minimal human habitation in the treatment areas.

- There is a long evolutionary and ecological history of environmental exposure of humans, plants and animals to organisms carrying *Wolbachia pipientis*, specifically *Culex* and *Aedes* mosquitoes and other invertebrates, with no recorded infection of *Wolbachia* in non-arthropod animals.
- As an obligate endosymbiont, *Wolbachia pipientis* cannot survive for any significant time outside the cells of its host arthropod As a result, there is no expected infective or direct exposure to humans and non-target organisms beyond what is already present due to ongoing environmental interactions.

In its "Final Registration Decision of the New Active Ingredient *Wolbachia pipientis* ZAP (wPip) strain in *Aedes albopictus* PC Code: 069035" (U.S. EPA, 2017a, published as EPA-HQ-OPP-2016-0205-0034), the EPA concluded that "Under the guidance of the National Academy of Sciences (NAS), EPA's Office of Pesticide Programs conducts assessments to evaluate the risks associated with the use of a pesticide. These assessments often evaluate the risk in the context of hazard and exposure using the following relationship:

Risk = Hazard x Exposure

Based on this equation, it follows that a small intrinsic hazard posed by the pesticidal substance and low levels of exposure both contribute to the reduction of the overall risk associated with the use of a pesticide. For the purposes of this [FIFRA Section 3 registration for ZAP mosquitoes], the *Wolbachia* ZAP strain will only be used in male *A. albopictus* mosquitoes. Male mosquitoes do not bite and do not feed on blood, and therefore do not significantly contribute to the exposure of humans to the *Wolbachia* ZAP strain. On the other hand, female mosquitoes bite to take blood meals to support the energy-intensive process of egg production." The EPA review goes on to state "The expected accidental release rate of 1 ZAP-infected female for every 250,000 ZAP-infected males is considered negligible exposure to humans resulting in a negligible human health risk and therefore meets the standard of no unreasonable adverse effects."

As described in publications (Crawford et al 2020), the Verily male mosquito manufacturing process includes multiple sex separation steps including 1) pupal separation based on the sexual dimporphism of male and female pupe whereby male pupae are typically smaller than female pupae, 2) visual adult sorting on eclosed adults whereby multiple photographs are taken of each individual mosquito and evaluated by machine vision for male and female characteristics. Together with Quality Control assays in the manufacturing process, these steps ensure <1:250,000 female:male in the released product, which is the female contamination required in the ZAP registration (EPA-HQ-OPP-2016-0205-0034). As described in (Crawford et al 2020), Verily may perform additional quality control checks including additional independent machine learning-based image reviews and human reviews, which significantly further reduce female contamination in the released product. For DQB males, these steps result in the expectation of a female contamination rate significantly lower than 1:250,000 during ongoing operations, with the process undergoing continual improvement.

We note that the Verily mosquito manufacturing process for DQB ensures that Mosquitoes are reared according to EPA and CDC guidelines so that colonies and released males will not be

infected with human or animal pathogens. The manufacturing process MRID 51991801 provides further details. In addition we note that released male mosquitoes do not, and cannot bite, and so they cannot transmit any such pathogens, and that releases will occur in conservation areas without human habitation

Risks to the Environment

Risks of removal of *Cx. quinquefasciatus*

None of the six species of biting mosquitoes present in Hawaii are native to the islands, and the Hawaii Department of Land and Natural Resources (DLNR) confirms that native wildlife do not rely on mosquitoes as a prey base (Winchester and Kapan, 2013). Hawaii's native fauna evolved over millions of years as constituents in a diverse community assemblage. In contrast, mosquitoes are comparatively recent introductions, having invaded Hawaii less than 200 years ago (Nishida 1994). *Culex quinquefasciatus* was introduced to the island of Maui in 1826 when a whaling vessel which traveled from Mexico docked at the Port of Lahaina (Van Dine, 1904). And, their subsequent slow spread to additional islands and habitats means their ecological interactions with native wildlife in some locations is even more limited in duration. Native taxa, which are generalist insectivores, do feed opportunistically on mosquitoes, however there are thousands of other arthropod food resources in the environment, including well over one hundred native and non-native aquatic Dipterans. The endangered Hawaiian hoary bat, one of only two mammals native to Hawaii, primarily eats larger-bodied prey such as beetles and moths (Pinzari et al, 2019). Native damselflies, including rare and endangered species, can persist in habitat where mosquitoes are present, but also thrive in habitat where mosquitoes are not yet present and/or are only observed in low abundance (Polhemus and Asquith, 1996). **As such, there are no anticipated repercussions of a diminished or eradicated population of *Cx. quinquefasciatus.***

Risks of Active ingredient or unintentional contaminants

As noted above, *WoIbachia pipientis* is an obligate intracellular bacterium, occurring naturally in many invertebrates, including, insects, isopods, ticks and filarial worms of humans and other animals (Casiraghi et aI., 2005; Saridaki & Bourtzis 2010). This includes up to 65% of insect species (Hilgenboecker et al. 2008, Kittayapong et al. 2008, Ruang-Areerate et al. 2003). Thus there is a long evolutionary and ecological history of environmental exposure of plants and animals to *Wolbachia pipientis,* including to the wAlbB in DQB males.

In its "Final Registration Decision of the New Active Ingredient *Wolbachia pipienti*s ZAP (wPip) strain in *Aedes albopictus* PC Code: 069035" (U.S. EPA 2017a published as EPA-HQ-OPP-2016-0205-0034), the **EPA concluded that "there is a history of ubiquitous environmental exposure to the bacterium and that, in conjunction with the data provided, no adverse effects to the environment, including endangered species, is expected as a consequence of the release."** The ecological risk assessments for the ZAP EUP and WB1

wAlbB in *Ae. aegypti* EUP made similar conclusions for low risk of adverse effects in non-target organisms. The Agency also concluded that "none of the potential effects [of *Wolbachia pipientis* outside of the target species] have either been documented to occur or are likely to occur within a timeframe relevant to the ZAP-infected mosquitoes' life-span." which would also apply to male DQB mosquitoes.

The "Ecological risk Assessment for *Wolbachia pipientis* wAlbB *Ae. aegypti* EUP 89668-EUP-3 extensions/amendment Decision #525796, DP #438208"(U.S. EPA 2017b published as EPA-HQ-OPP-2017-0392-0002) summarized earlier Agency reviews of incompatible *Wolbachia pipientis* in male *Ae. aegypti* (and specifically to wAlbB *Wolbachia pipientis* which is the subtype present in DQB males) and stated that "Adverse effects are not expected for birds or wild mammals as a result of the release of mosquitoes infected with *W. pipientis* wAlbB strain" and separately stated that the "rationale [provided for earlier reviews of risks of *Wolbachia pipientis* to non-target organism] was acceptable for the EUP and section 3 of the ZAP strain and are thus considered acceptable for wAlbB *Aedes aegypti* [...]" Additionally they stated that "EPA's conclusion that male Ae. aegypti mosquitoes carrying the wAlbB strain of W. pipientis will not cause adverse effects to non target organisms is independent of the number of males released and release locations." This same reasoning should apply to *Wolbachia pipientis* strain wAlbB in DQB, and we likewise conclude that no adverse effects are likely to occur in non-target plants or animals from the labeled release of DQB male adult *Ae. aegypti* mosquitoes.

SECTION 166.20(a)(8): COORDINATION WITH OTHER AFFECTED FEDERAL OR STATE AGENCIES

The following state/federal agencies were notified of the Hawaii Department of Agriculture's (HDOA's) actions to submit an application for a Specific Exemption, under Section 18 of FIFRA, to EPA:

- Hawaii Department of Health: Environmental Management Division
- University of Hawaii Pesticides Program
- Hawaii Department of Land and Natural Resources: Division of Forestry and Wildlife
- United States Fish and Wildlife Service: Pacific Islands Fish and Wildlife Office
- United States National Park Service: Biological Resource Division
- United States Geological Survey

SECTION 166.20(a)(9): ACKNOWLEDGEMENT BY REGISTRANT

Verily Life Sciences LLC has been notified of HDOA's intent regarding this application (see attached letter of support, submitted as an attachment with this packet). They have also provided a copy of a label with the Specific Exemption use directions.

SECTION 166.20(a)(10): DESCRIPTION OF PROPOSED ENFORCEMENT PROGRAM

Hawaii Department of Agriculture has the authority to regulate the distribution, storage, sale, use and disposal of pesticides in Hawaii. In addition, the EPA/HDOA grant enforcement agreement provides the Department with the authority to enforce the provisions of FIFRA, as amended, within the State. Therefore, HDOA will make at least one random, unannounced call per week on applicators participating in the Section 18 Specific Exemption program for Male DQB to check for compliance with provisions of the Specific Exemption. If violations are discovered appropriate enforcement action will be taken.

Notification and contact information from the previous seven (7) days will be placed into a sorted spreadsheet by island. Applicators will all be assigned a random number via RAND function and sorted highest to lowest. The contact information of the applicator at the top of the list will then be provided to credentialed inspectors to contact for inspection scheduling. If the inspector cannot contact the applicator within one (1) business day the inspector will request a new applicator from the Pesticides Program Manager. This process will be continued for at least the first three months after exemption approval to ensure appropriate use.

SECTION 166.20(a)(11): REPEATED USES

This is the first time that HDOA has applied for this Specific Emergency Exemption.

SECTION 166.25(b)(2)(ii): PROGRESS TOWARDS REGISTRATION

Verily Life Sciences LLC is working towards a Section 3 registration for Male DQB. The Section 3 registration is expected to be submitted in 2023 if the Section 18 Specific Emergency Exemption is approved. As such Section 3 approval is anticipated by the end of calendar year 2024.

The Section 3 label is expected to be submitted in 2023 if the Section 18 specific exemption is approved. Section 3 approval is anticipated by the end of calendar year 2024.

SECTION 166.20(b)(1): NAME OF PEST

Culicid Mosquito, Wild Type *Culex quinquefasciatus.*

Culex quinquefasciatus is a non-native Culicid that invaded Hawai'i ~100 years ago from ship ballasts (Samuel et al. 2011). In Hawai'i, densities of Cx. quinquefasciatus are correlated with temperature and standing water (generally eutrophic) availability (Matthew E. Reiter and LaPointe 2009). As Hawai'i is a mountainous tropical archipelago in the Pacific Ocean with a number of native rain forests at both lower and upper elevations, variance of Cx. quinquefasciatus densities in Hawai'i are largely associated with elevational (i.e. temperature) gradients (Samuel et al. 2011; M.E. Reiter and LaPointe 2007). As Cx. quinquefasciatus females must take a blood meal to complete a gonotrophic cycle, and they feed on a wide array of animals, including humans, they are implicated in a number of zoonotic diseases (e.g. west nile virus, japanese encephalitis etc.), as well as diseases of agricultural (e.g. dog heartworm) and conservation (e.g. avian malaria) significance (please see Attachment C, Table 1). Only avian malaria, avian pox, and dog heartworm, diseases caused by pathogens of agricultural and conservation concern, are transmitted by Cx. quinquefasciatus in Hawai'i (Samuel et al. 2018; Ash 1962). For a detailed review of the ecology and biology of Cx. quinquefasciatus in Hawai'i, as well as an overview of pathogens Cx. quinquefasciatus transmits, please see Attachment C.

SECTION 166.20(b)(2): DISCUSSION OF EVENTS WHICH BROUGHT ABOUT THE EMERGENCY CONDITION

Avian malaria, introduced into the Hawaiian islands in the 19th century and spread by a non-native mosquito (*Culex quinquefasciatus*), has resulted in devastating effects to Hawaii's endemic and iconic forest birds. Already threatened by habitat loss and predation by invasive predators, avian malaria reduced the diverse forest bird assemblage from more than 50 species known historically down to only 23 remaining extant species, 15 of which are listed as threatened or endangered. The remaining species are now restricted to the highest elevations of Hawaii's mountains, where it is too cold for mosquitoes and avian malaria to persist. However, as climate change increases temperatures, mosquitoes are ascending into the highest elevations of remaining forest bird habitat; resulting in further range restriction and population declines. Areas previously thought safe for forest birds are now inundated with mosquitoes, including Haleakala National Park, Hawaii Volcanoes National Park, and numerous State-owned lands managed for forest bird conservation.

Despite ongoing efforts to support Hawaii's forest bird recovery through an array of long-standing partnerships, there are no current management tools to address the mosquito/disease threat. Without a means of mosquito control at a landscape-level, the survival and recovery of Hawaii's few remaining forest birds are at imminent risk. Updated information collected in early 2021 indicates that the extinction of four or more of the remaining species is likely to occur within the next few years due to avian malaria.

Over the last six years, the State of Hawaii, the Pacific Islands Fish and Wildlife Office (PIFWO), and our conservation partners have worked to identify and develop conservation strategies to address this crisis. After thorough review, the use of an Incompatible Insect Technique (IIT), Wolbachia infected mosquitoes, has been identified as the fastest option for suppressing mosquitoes at a landscape-scale. Wolbachia is a naturally occurring bacteria; when mosquitoes carrying the bacteria breed with other mosquitoes, they only produce non-viable eggs leading to population suppression. While this tool has been successfully deployed in urban areas for public health around the world, it has never been attempted for a conservation application in a remote forest setting.

The conservation partners have established a Birds, Not Mosquitoes Steering Committee to lead the collaborative effort in developing and implementing Wolbachia IIT in Hawaii. Initial implementation of the tool is expected in 2023; however, there are numerous compliance, infrastructure, financial and technical milestones that must be met to support this timeline. Effective implementation is not likely to come in time for some forest bird species; therefore, PIFWO continues to work with our partners to identify interim actions to prevent their extinction (USFWS memo, 2021).

Additional support for this program and intervention is provided by the following resolutions:

- Hawaii Invasive Species Council adopted Resolution 17-2 in 2017, supporting research and evaluation of landscape-scale control technologies for mosquitoes, and encouraging researchers to approach this research in a way that could potentially benefit both native wildlife and human health in Hawaii https://dlnr.hawaii.gov/hisc/files/2013/02/HISC-Reso-17-2-Mosquitoes.pdf
- House Resolution (HR) 297 passed the Hawaii State House in 2019, and directed "DOA to review the Aedes aegypti mosquito with Wolbachia bacteria, including Aedes aegypti mosquitoes originating from Hawaii stock that could be imported for landscape scale mosquito control, and render a determination to place it on the appropriate animal import list. Requires DOA, DOH, and DLNR to collaborate on a report to the Legislature with recommendations for appropriate vector control programs. https://www.capitol.hawaii.gov/session2019/bills/HB297_SD1_.htm
- House Resolution (HR) 95 passed the Hawaii State House in 2021 urging DLNR, DOA, DOH and UH to implement a mosquito control program using Wolbachia to reduce mosquito population levels throughout the state. https://www.capitol.hawaii.gov/session2021/bills/HR95_HD1_.htm

Areas affected (counties of geographical locations).

The State of Hawaii counties of Honolulu, Hawaii, Kauai, Niihau, and Maui.

SECTION 166.20(b)(4)(i, ii, iii): DISCUSSION OF ANTICIPATED ECONOMIC LOSS

Not applicable to this application.

SECTION 166.20(b)(3): DISCUSSION OF ANTICIPATED RISKS TO ENDANGERED OR THREATENED SPECIES, BENEFICIAL ORGANISMS, OR THE ENVIRONMENT

Endangered and Threatened Species in Hawaii

Overview

Due to the biological nature of *Wolbachia*, the proposed application of DQB Males in forested and non-crop areas in Hawaii is unlikely to adversely affect federally listed T&E species. The use of DQB Males to control mosquitoes in forested and non-crop areas is intended to reduce the abundance of *Cx. quinquefasciatus* mosquitoes which are known to vector avian malaria to T&E bird species.

Furthermore, no harm to listed plants, invertebrates or birds is expected to occur as a result of IIT application. The DLNR-DOFAW, and designated agents of the State, have the authority to conduct the conservation and management activities outlined in this application, including accessing State lands, conducting helicopter operations, and completing invasive species research, management, and control. Staff and partners will use existing trails to access field sites. To prevent the spread of invasive insects, plants and plant diseases all equipment will be washed and decontaminated between field excursions. In the event that helicopters are used to transit to field sites, they will only land on preexisting designated landing zones, therefore causing no additional negative impacts from downwash and noise, and no additional impacts to native vegetation. DLNR has a staff entomologist, malacologist, botanist, and forest bird biologist who are included in planning, site selection and project implementation. Final treatment areas will be selected in cooperation with USFWS PIFWO staff.

Listed invertebrate species present:

Maui – Blackburn's sphinx moth (*Manduca blackburni*) may be present within the proposed treatment areas, however we do not expect field activities will have any positive or negative impact on the species. *Manduca blackburni* is not typically present in closed canopy wet forest areas as its host plants are native to mesic and dry forest habitat. Nonetheless, staff will be trained to identify the species and its associated host plants.

Kauai - Endemic picture-wing fly *Drosophila musaphilia* is present within the proposed treatment areas. The DLNR-DOFAW entomologist will ensure that staff and partners are aware of locations of existing populations and can recognize known host plants. As a result, we do not expect to have any positive or negative impacts on the species.

Hawaii Island - While no populations are known to be extant, endemic picture-wing flies *D. ochrobasis* and *D. heteroneura* may be present within the proposed treatment areas. The DLNR-DOFAW will ensure that staff and partners can recognize known host plants. As a result, we do not expect to have any positive or negative impacts on the species.

The DLNR-DOFAW Hawaii Invertebrate Program and the Snail Extinction Prevention Program have not identified additional sensitive locations of existing T/E insect or snail populations within the proposed treatment areas but will be consulted if additional populations are detected. As a result, we do not expect to have any positive or negative impact to any additional listed invertebrate species.

Listed bird species present:

Several threatened and endangered waterbird, forest bird and seabird species are confirmed or may be present and breeding in the project areas. To prevent negative impacts to these species we will use existing trails, camps and helicopter landing zones to access treatment areas. Mosquito suppression will have a positive impact on forest bird species. We do not anticipate negative impacts.

Maui -

Kiwikiu or Maui parrotbill, *Pseudonestor xanthophrys*

‘Akohekohe, *Palmeria dolei*

‘I‘iwi, *Drepanis coccinea*

‘Ua‘u or Hawaiian petrel *Pterodroma sandwichensis*

'A'o or Newell's shearwater, *Puffinus newelli*

‘Ake‘ake or Band-rumped storm-petrel, *Hydrobates castro*

Nēnē, *Branta sandvicensis*

Kauai -

‘Akikiki, *Oreomystis bairdi*

‘Akeke‘e, *Loxops caeruleirostris*

‘I‘iwi, *Drepanis coccinea*

Puaiohi, *Myadestes palmeri*

‘Ua‘u or Hawaiian petrel *Pterodroma sandwichensis*

ʻAkeʻake or Band-rumped storm-petrel, *Hydrobates castro*

Nēnē, *Branta sandvicensis*

Hawaii Island -

ʻAkiapolaʻau, *Hemignathus wilsoni*

Hawaiʻi ʻakepa, *Loxops coccineus*

Palila, *Loxioides bailleui*

ʻIʻiwi, *Drepanis coccinea*

ʻAlawī or Hawaiʻi creeper, *Loxops mana*

ʻUaʻu or Hawaiian petrel *Pterodroma sandwichensis*

ʻAkeʻake or Band-rumped storm-petrel, *Hydrobates castro*

Nēnē, *Branta sandvicensis*

Listed mammal species present:

Kaui, Maui and Hawaii Island – The Hawaiian bat (*Lasiurus cinereus semotus*) is present in the proposed treatment areas. The Hawaiian hoary bat is an insectivore, however it evolved in the absence of mosquitoes, and its diet primarily consists of larger-bodied prey such as beetles and moths. As such, we do not expect the reduced abundance of *Cx. quinquefascatius* to have any positive or negative impacts on bat populations.

Listed plant species present: (better to insert tables after editing)

To prevent negative impacts to rare, threatened and endangered plants we will use existing trails and helicopter landing zones to access treatment areas. No vegetation will be cleared or disturbed. Between field sites all gear will be decontaminated to prevent the spread of invasive plant seeds and diseases. To prevent the spread of rapid ohia death, no field gear used on the Big Island will be used on Maui or Kauai. DLNR-DOFAW island botanists, as well as staff from the Plant Extinction Prevention Program, have identified listed plants known to occur within the treatment area and will be consulted if additional populations are detected. As a result, we do not expect to have any positive or negative impact to any listed plant species.

Maui Plant Taxon Name	Fed Status

Asplenium peruvianum var. insulare	Endangered
Bidens campylotheca subsp. pentamera	Endangered
Bidens campylotheca subsp. waihoiensis	Endangered
Calamagrostis expansa	Endangered
Clermontia samuelii subsp. hanaensis	Endangered
Clermontia samuelii subsp. samuelii	Endangered
Cyanea asplenifolia	Endangered
Cyanea copelandii subsp. haleakalensis	Endangered
Cyanea hamatiflora subsp. hamatiflora	Endangered
Cyanea horrida	Endangered
Cyanea kunthiana	Endangered
Cyanea maritae	Endangered
Cyanea mceldowneyi	Endangered
Cyrtandra ferripilosa	Endangered
Deparia kaalaana	Endangered
Diplazium molokaiense	Endangered
Gardenia remyi	Endangered
Geranium arborerum	Endangered

Geranium hanaense	Endangered
Geranium multiflorum	Endangered
Joinvillea ascendens subsp. ascendens	Endangered
Melicope balloui	Endangered
Melicope ovalis	Endangered
Menisciopsis boydiae	Endangered
Microlepia strigosa var. mauiensis	Endangered
Nothocestrum longifolium	Endangered
Ochrosia haleakalae	Endangered
Peperomia subpetiolata	Endangered
Phlegmariurus mannii	Endangered
Phyllostegia bracteata	Endangered
Phyllostegia brevidens	Endangered
Phyllostegia haliakalae	Endangered
Phyllostegia pilosa	Endangered
Plantago princeps var. laxifolia	Endangered
Platanthera holochila	Endangered
Schiedea diffusa subsp. difusa	Endangered

Wikstroemia villosa	Endangered

Kauai Plant Taxon Name	**Federal Status**
Adenophorus periens	Endangered
Alectryon macrococcus var. macrococcus	Endangered
Asplenium dielpallidum	Endangered
Astelia waialealae	Endangered
Bonamia menziesii	Endangered
Brighamia insignis	Endangered
Canavalia napaliensis	Endangered
Cyanea recta	Endangered
Cyanea rivularis	Endangered
Cyrtandra kealiae subsp. kealiae	Endangered
Cyrtandra paliku	Endangered
Dryopteris glabra var. pusilla	Endangered
Dubautia latifolia	Endangered
Dubautia pauciflorula	Endangered
Dubautia waialealae	Endangered

Euphorbia halemanui	Endangered
Euphorbia halemanui	Endangered
Euphorbia remyi var. kauaiensis	Endangered
Euphorbia remyi var. remyi	Endangered
Euphorbia remyi var. remyi	Endangered
Exocarpus luteolus	Endangered
Geniostoma helleri	Endangered
Geranium kauaiense	Endangered
Hibiscadelphus distans	Endangered
Hibiscus clayi	Endangered
Ischaemum byrone	Endangered
Isodendrion longifolium	Threatened
Joinvillea ascendens subsp. ascendens	Endangered
Joinvillea ascendens subsp. ascendens	Endangered
Keysseria helenae	Endangered
Lobelia niihauensis	Endangered
Lysimachia daphnoides	Endangered
Lysimachia pendens	Endangered

Melicope degeneri	Endangered
Melicope Haupuensis	Endangered
Melicope pallida	Endangered
Melicope paniculata	Endangered
Melicope puberula	Endangered
Melicope rostrata	Endangered
Melicope rostrata	Endangered
Myrsine fosbergii	Endangered
Myrsine knudsenii	Endangered
Myrsine linearifolia	Endangered
Myrsine mezii	Endangered
Nothocestrum latifolium	Endangered
Nothocestrum peltatum	Endangered
Peucedanum sandwicense	Threatened
Phyllostegia helleri	Endangered
Phyllostegia renovans	Endangered
Pittosporum napaliense	Endangered
Platanthera holochila	Endangered

Poa mannii	Endangered
Poa sandvicensis	Endangered
Poa siphonoglossa	Endangered
Polyscias racemosa	Endangered
Pritchardia viscosa	Endangered
Psychotria grandiflora	Endangered
Psychotria hobdyi	Endangered
Pteralyxia kauaiensis	Endangered
Ranunculus Mauiensis	Endangered
Remya kauaiensis	Endangered
Schiedea helleri	Endangered
Schiedea lychnoides	Endangered
Schiedea membranacea	Endangered
Schiedea spergulina	Endangered
Schiedea viscosa	Endangered
Sesbania tomentosa	Endangered
Solanum sandwicense	Endangered
Spermolepis hawaiiensis	Endangered

Stenogyne kealiae	Endangered
Wilkesia hobdyi	Endangered
Xylosma crenatum	Endangered

Hawaii Island Plant Taxon Name	**Federal Status**
Abutilon menziesii	Endangered
Achyranthes mutica	Endangered
Adenophorus periens	Endangered
Argyroxiphium kauense	Endangered
Argyroxiphium sandwicense subsp. sandwicense	Endangered
Asplenium dielerectum	Endangered
Asplenium peruvianum var. insulare	Endangered
Bidens hillebrandiana subsp. hillebrandiana	Endangered
Bidens micrantha subsp. ctenophylla	Endangered
Bonamia menziesii	Endangered
Calamagrostis expansa	Endangered
Cenchrus agrimonioides var. agrimonioides	Endangered
Clermontia drepanomorpha	Endangered

Clermontia lindseyana	Endangered
Clermontia peleana subsp. peleana	Endangered
Clermontia peleana subsp. singuliflora	Endangered
Clermontia pyrularia	Endangered
Colubrina oppositifolia	Endangered
Cyanea copelandii subsp. copelandii	Endangered
Cyanea hamatiflora subsp. carlsonii	Endangered
Cyanea marksii	Endangered
Cyanea platyphylla	Endangered
Cyanea shipmanii	Endangered
Cyanea stictophylla	Endangered
Cyanea tritomantha	Endangered
Cyperus fauriei	Endangered
Cyrtandra giffardii	Endangered
Cyrtandra nanawaleensis	Endangered
Cyrtandra tintinnabula	Endangered
Cyrtandra wagneri	Endangered
Delissea argutidentata	Endangered

Deparia kaalaana	Endangered
Dracaena konaensis	Endangered
Exocarpos menziesii	Endangered
Festuca hawaiiensis	Endangered
Flueggea neowawraea	Endangered
Gardenia brighamii	Endangered
Gardenia remyi	Endangered
Gouania vitifolia	Endangered
Haplostachys haplostachya	Endangered
Hibiscadelphus giffardianus	Endangered
Hibiscadelphus hualalaiensis	Endangered
Hibiscus brackenridgei subsp. brackenridgei	Endangered
Ischaemum byrone	Endangered
Isodendrion hosakae	Endangered
Isodendrion pyrifolium	Endangered
Joinvillea ascendens subsp. ascendens	Endangered
Kadua cookiana	Endangered
Kadua coriacea	Endangered

Kokia drynarioides	Endangered
Melicope remyi	Endangered
Melicope zahlbruckneri	Endangered
Mezoneuron kavaiense	Endangered
Microlepia strigosa var. mauiensis	Endangered
Neraudia ovata	Endangered
Nothocestrum breviflorum	Endangered
Ochrosia haleakalae	Endangered
Ochrosia kilaueaensis	Endangered
Phlegmariurus mannii	Endangered
Phlegmariurus stemmermanniae	Endangered
Phyllostegia brevidens	Endangered
Phyllostegia floribunda	Endangered
Phyllostegia parviflora var. glabriuscula	Endangered
Phyllostegia racemosa	Endangered
Phyllostegia stachyoides	Endangered
Phyllostegia velutina	Endangered
Phyllostegia warshaueri	Endangered

Pittosporum hawaiiense	Endangered
Plantago hawaiensis	Endangered
Plantago princeps var. laxifolia	Endangered
Portulaca sclerocarpa	Endangered
Portulaca villosa	Endangered
Pritchardia lanigera	Endangered
Pritchardia maideniana	Endangered
Pritchardia schattaueri	Endangered
Ranunculus hawaiensis	Endangered
Ranunculus mauiensis	Endangered
Sanicula sandwicensis	Endangered
Scaevola coriacea	Endangered
Schiedea diffusa subsp. difusa	Endangered
Schiedea diffusa subsp. macraei	Endangered
Schiedea hawaiiensis	Endangered
Sesbania tomentosa	Endangered
Sicyos albus	Endangered
Sicyos macrophyllus	Endangered

Silene hawaiiensis	Threatened
Silene lanceolata	Endangered
Solanum incompletum	Endangered
Solanum nelsonii	Endangered
Spermolepis hawaiiensis	Endangered
Stenogyne angustifolia	Endangered
Stenogyne cranwelliae	Endangered
Tetramolopium arenarium subsp. arenarium	Endangered
Vicia menziesii	Endangered
Vigna o-wahuensis	Endangered
Wollastonia venosa	Endangered
Zanthoxylum dipetalum var. tomentosum	Endangered
Zanthoxylum hawaiiense	Endangered

Benefits of action to Threatened and Endangered species

- The number of endemic forest bird passerines of Hawaii has declined from 58 described species to only 22 known to be alive in the wild today. Of these 22 species remaining in the wild, 14 are listed as threatened or endangered, including 11 honeycreeper species. The remaining honeycreeper species are now restricted to upper elevation refuges from avian malaria and its vector *Cx. quinquefasciatus*. Mosquitoes are now invading these last remaining native refugia due to climate change induced temperature increases. Projections of recently obtained data predict the extinction of four or more of the remaining species within the next few years. There are no current management tools

compatible with Hawaii's topographically complex and remote native refugia that can effectively address the mosquito threat across the landscape. To preserve Hawaii's forest birds for future generations an efficient and effective landscape level tool must be applied to control *Cx. quinquefasciatus*, the primary vector of avian malaria. Current models indicate that in the absence of avian malaria the potential habitable range for native forest birds would increase significantly. The use of IIT to suppress mosquito reproduction and population size in forest bird habitats, potentially preserving and expanding existing refugia, would help to reduce the probability of a threatened or endangered species going extinct in the near future. If conducted in an efficient and timely manner the application of IIT will act as a stop-gap until the implementation of broadly expansive climate action.

- Hawaii's forest birds act as seed dispersers and pollinators and are ecologically significant to the ecosystem in which they inhabit. The extinction of Hawaiian forest birds will directly impact native ecosystems and forests such that their loss may beget a cascading effect throughout the ecosystem, indirectly causing the decline and extinction of other threatened or endangered species.

- These native ecosystems are also predominantly watersheds. Extensive modifications of these ecosystems could cause drastic reductions in water uptake and distribution for natural and anthropogenic needs (e.g. drinking water, agriculture, T&E stream inhabitants etc). As Hawaii is isolated from any other fresh water sources, the preservation of these native watersheds is of the utmost importance.

Cultural benefits

- The recent report produced by U.S. Geological Survey, U.S. Fish and Wildlife Service, and U.S. Office of Native Hawaiian Relations provided the most up-to-date scientific and biocultural information available. From the report:

> "*A majority of Native Hawaiian participants viewed management decisions around 'akikiki, 'akeke'e, kiwikiu, and 'ākohekohe akin to making end of life choices for members of their 'ohana. While most participants thought immediate steps should be taken to prevent the extinction of these species, extinction was not always considered the worst-case scenario. Instead, the likelihood of success; welfare of individual birds; and social, biocultural, and cultural connection of the birds to their natural environment were significant considerations when evaluating management options. If these considerations could not be fully realized, some participants considered it more appropriate to allow the birds to go extinct in their natural environment without further intervention, akin to allowing a member of their 'ohana to breathe their last breath in their "one hānau," or birthplace.*"
>
> (Eben, et. al. 2022)

- Hawaii's forest birds have been revered, honored and deified by Native Hawaiians for centuries, this is definitive of the deep kinship that Native Hawaiians and Hawaiian forest birds share (Eben et al. 2022).

- Effectively implementing IIT in a timely manner will enable Hawaii's forest birds to maintain and potentially expand their populations in their native ecosystems, thereby reducing and/or removing any impact that captive rearing may have on these culturally and ecologically significant resources.

Direct Economic Benefits

- As noted previously many Hawaiian forest birds are seed dispersers and pollinators, and thus the ecosystem in which they inhabit directly benefits from their presence. Hawaiian forest bird refugia are primarily watersheds which maintain the freshwater aquifers on all of the main Hawaiian islands. A single watershed on Oahu was estimated to provide groundwater drinking services of around $14 billion (Kaiser et al., 2008); there are ~437 watersheds on the main eight Hawaiian islands (Atlas of Hawaiian watersheds, 2008). Modifications to these ecosystems caused by the removal of a seed disperser and pollinator may have a down-stream detrimental effect on these native watersheds, and thus aquifers. These modifications may reduce fresh water uptake and cause excessive erosion, detrimentally affecting agricultural yields and other anthropogenic uses (e.g. drinking water, tourism, cost-of-living, food prices etc.).

- No direct estimate of the annual contribution of bird watching (birding) to Hawaii's economy exists, but national and regional projections can be used as a proxy to estimate local contribution minimums. Haleakalā (Maui) and Hawaii Volcano (Island of Hawaii) National Parks hosted 2,160,975 visitors in 2018, generating an estimated $161,559,000 for the local economy in the State of Hawaii (Thomas et al., 2021). These parks include both spectacular scenery and an expansive array of native species, including many native forest birds. In the United States the outdoor recreation economy was estimated to generate ~ $800 billion annually (Roberts 2017), and birding in 2011 was estimated to have generated ~$40 billion (of that ~$800 billion), or ~5% of the outdoor recreation economy (USFWS 2013). Applying this proportion to the visitor spending in and around these two Hawaii National Parks predicts that birding generates at minimum ~$8 million annually in the State of Hawaii. If these numbers are broadly applied to both Oahu and Kauai (i.e. ~$4 million each) then the projected annual income generated from birders in Hawaii would be ~$16 million. Maintaining these Federally protected natural heritage resources will allow the continued economic influx from birding into Hawaii's economy.

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Opinion

Wolbachia Can Enhance *Plasmodium* Infection in Mosquitoes: Implications for Malaria Control?

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The symbiotic bacterium *Wolbachia* is an attractive agent for vector-borne pathogen control. It has long been studied for its ability to manipulate host reproduction and spread into arthropod populations [1]. These properties, coupled with the recently identified ability to inhibit diverse pathogens [2–6], open avenues for its use in controlling vector-borne disease. Numerous *Wolbachia*-based control strategies are being investigated (reviewed in [7–9]), with some studies having progressed to field trials [10,11]. However, a worrying trend is emerging whereby *Wolbachia* infections have been demonstrated to enhance rather than suppress pathogens in some systems [12–18]. *Plasmodium* parasites, which are the causal agent of malaria, seem particularly prone to *Wolbachia*-mediated pathogen enhancement [13–16].

Wolbachia-based strategies have been proposed to control malaria [19]. *Anopheles* mosquitoes (the vectors of human malaria parasites) are not naturally infected by *Wolbachia* [20,21], but artificial transfer of this bacterium between species can be accomplished in the laboratory (reviewed in [22]). Pathogen interference phenotypes appear to be most prominent when *Wolbachia* is transferred into a novel host [16,23]. Given that *Anopheles* are for the most part naturally uninfected by *Wolbachia* (but see [24]), they can be considered an open niche for infection and a prime mosquito genus for *Wolbachia*-based control strategies. However, the main impediment for developing a control strategy is the difficulty in creating a stable artificial infection in *Anopheles* [19]. While examining *Plasmodium* interference in a stably infected host is the gold standard, a more convenient system is to transiently infect mosquitoes by intrathoracic microinjection. Using this system, the infection persists during the lifetime of the transinfected individual but is not transmitted to its offspring. Transient infection allows the rapid assessment of *Wolbachia*-host interactions without the need for generating stable artificial infections [5]. It is uncertain how representative transient infections are of stable inherited associations; however, similarities in tissues tropism and fitness costs incurred upon the host between stable and transiently infected *Anopheles* mosquitoes are evident [5,14,25]. Furthermore, both types of infection have been shown to inhibit the human malaria parasite *Plasmodium falciparum* [5,25]. However, studies using transient infection models have found that *Wolbachia* can enhance certain *Plasmodium* species [13,14].

The *Plasmodium* interference phenotype is therefore not universal, but context dependent. While *P. falciparum* is suppressed by the *w*AlbB strain of *Wolbachia* from *Aedes albopictus* [5,25], transient infections have shown the opposite effect on rodent malaria parasites. *Anopheles gambiae* transiently infected with *w*AlbB exhibited enhanced *P. berghei* development at the oocyst stage [14]. Similarly, *w*AlbB increased the number of *P. yoelii* oocysts in *An. stephensi*, although the phenotype was modulated by temperature [13]. At a temperature optimal for parasite development, *Wolbachia* increased parasite intensity compared to uninfected controls, but at warmer temperatures, *Wolbachia* inhibited *Plasmodium* development [13].

While *P. falciparum* is a major parasite in sub-Saharan Africa, four other parasites also cause human malaria worldwide: *P. malariae*, *P. ovale*, *P. knowlesi,* and *P. vivax* (the etiological agent of the most prevalent form of relapsing malaria). To our knowledge, the effect of *Wolbachia* on these other human *Plasmodium* parasites is unknown. The question is relevant for two reasons. First, the precedent that a particular *Wolbachia* strain can inhibit one parasite yet enhance another has already been documented [5,14], indicating that effects on parasites can be species-specific. Troublingly, *P. malariae*, *P. ovale*, *P. knowlesi*, and *P. vivax* are phylogenetically more closely related to rodent malaria parasites, which are enhanced by *Wolbachia* infections [13,14], than they are to *P. falciparum* (Figure 1) [26,27]. Second, many human *Plasmodium* parasites occur in sympatry and are transmitted by the same vectors. A case in point is *P. falciparum* and *P. vivax*, both of which occur in sympatry over large stretches of the Asian continent where they are both transmitted by *An. stephensi* [28,29]. Any potential control strategy devised in regions where more than one parasite species occurs needs to thoroughly investigate the effect of *Wolbachia* on all parasite species transmitted by the vector, as well as other pathogens such as filarial worms or arboviruses (both as single infections and in the context of coinfections) to ensure that *Wolbachia*-infected mosquitoes do not inadvertently enhance transmission of secondary pathogens.

While difficult, forecasting the long-term evolutionary response in this tripartite relationship between *Wolbachia*, *Plasmodium,* and *Anopheles* is very important. Natural *Wolbachia*–mosquito associations in which the symbiont and the host have tightly coevolved exist and may provide powerful models for studying the long-term evolutionary effects of *Wolbachia*

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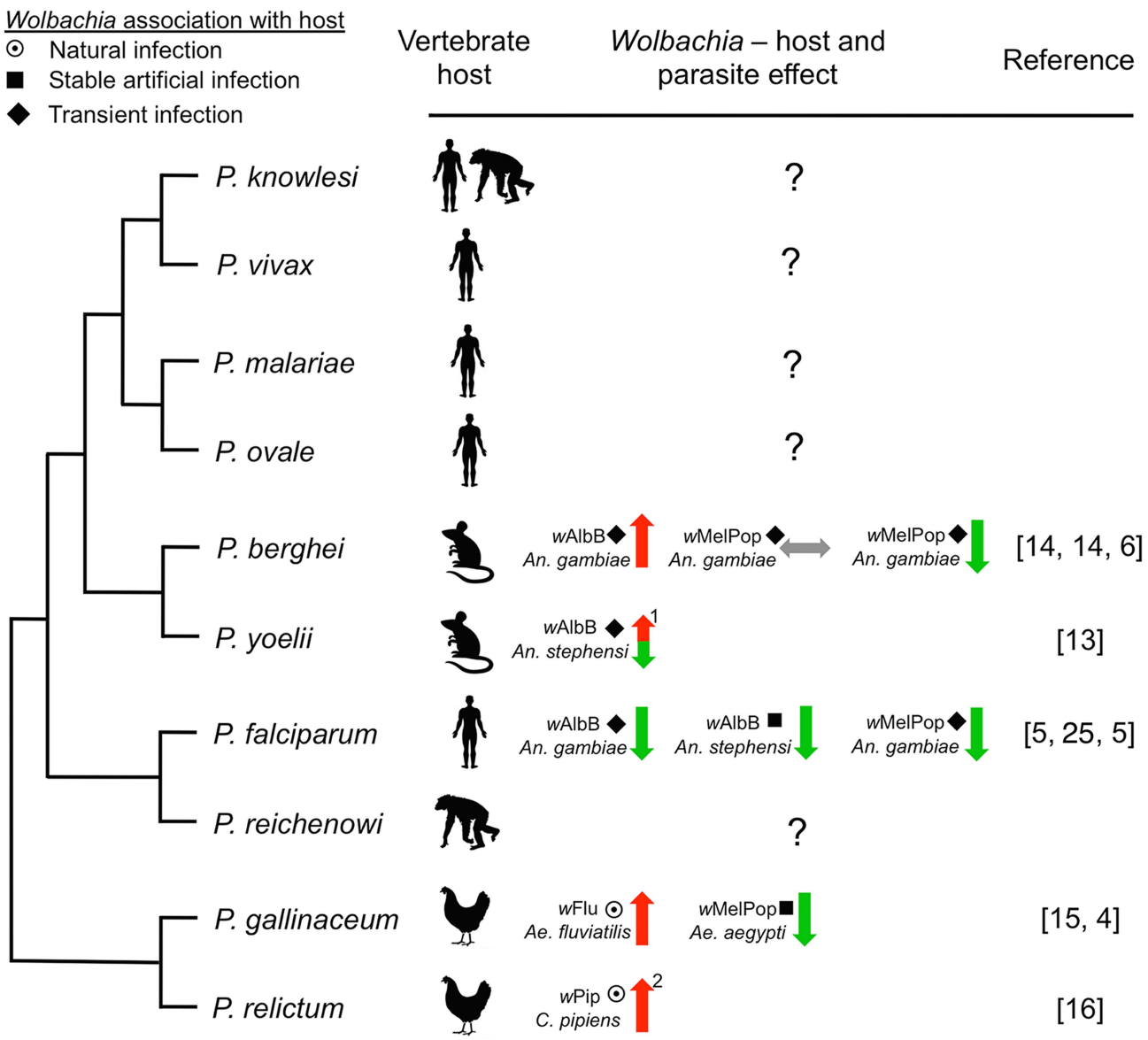

Figure 1. Representative phylogenetic dendrogram of *Plasmodium* parasites, their vertebrate hosts, and the influence of *Wolbachia* infection on parasite development within the mosquito vector. The protective effect of *Wolbachia* is variable and dependent on the *Wolbachia* strain and the insect host background, suggesting that complex tripartite interactions influence the effect on *Plasmodium*. The type of association between *Wolbachia* with the vector may also influence *Plasmodium*. Only one human malaria parasite (*P. falciparum*) has been assessed, while the effect of *Wolbachia* infection on the other four human parasites is unknown. Arrows indicate suppression (green), enhancement (red), or no effect (grey) of *Plasmodium*. The type of association within the host is depicted by symbols (target: natural infection, square: stable artificial infection, diamond: transient artificial infection). Numbers indicate: (1) the phenotype is temperature sensitive, (2) *Wolbachia* infection also increases insect life span [31], which has implications for pathogen transmission. Phylogeny was reconstructed based on work from Carlton et al. [26] and Martinsen et al. [27].
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infections. The evidence currently available suggests that natural *Wolbachia* infections can also enhance malaria parasite development within the mosquito. *Aedes fluviatilis* naturally infected with the *w*Flu *Wolbachia* strain had a significantly higher number of *P. gallinaceum* oocysts compared to an *Ae. fluviatilis* line which had been cleared of the *Wolbachia* infection [15]. *Ae. fluviatilis* is not, however, a natural vector of *P. gallinaceum*, and it is well known that the outcome of experiments using such laboratory models can differ significantly from those of natural mosquito–*Plasmodium* combinations (e.g., Boete [30]). Recent studies carried out in *Culex pipiens* mosquitoes, which are naturally infected with the *w*Pip *Wolbachia* strain and transmit the avian malaria parasite *P. relictum*, have also demonstrated *Plasmodium* enhancement. In this natural system, *Wolbachia* protects the mosquito host against the detrimental fitness effects incurred by *Plasmodium* infection [31] and increases the susceptibility of *C. pipiens* to *P. relictum*, with *w*Pip-infected mosquitoes having a higher prevalence of *Plasmodium* sporozoites in the salivary glands [16]. These studies show that the

Plasmodium-inhibiting properties of *Wolbachia* are far from universal; certain mosquito–*Wolbachia*–*Plasmodium* combinations and experimental conditions transform *Wolbachia*-infected mosquitoes into better vectors of malaria parasites. This is worrisome for the general implementation of *Wolbachia*-based control strategies.

Given that *Wolbachia*-based control strategies will use stable transinfected mosquitoes, the key question is whether stable and natural infections will behave in the same way. The stable transfer of *Wolbachia* into the host likely alters many aspects of host homeostasis, as evidenced by the novel phenotypes induced by infection [32–34], and as such, these associations likely differ from natural associations where *Wolbachia* and its host have coevolved. Another question is whether stable artificial infections will evolve over time. Theory and empirical studies show that these maternally transmitted bacteria will tend to evolve towards mutualistic associations with their host [35–38]. However, the evolutionary outcomes of pathogen interference or enhancement are harder to predict. A more complete mechanistic understanding of how *Wolbachia* infection modulates *Plasmodium* parasites is critical to address these important evolutionary questions and to evaluate if they are likely to occur in timescales relevant for disease control.

To date, two stable artificial *Wolbachia* transinfections have been assessed for their effect on *Plasmodium*. First, an *Aedes aegypti* line infected with *w*MelPop had inhibited *P. gallinaceum* infection [4]; *Ae. aegypti* is not, however, the natural vector of this parasite. Second, and more recently, the *w*AlbB strain was stably transferred into *An. stephensi*, one of the main vectors of human malaria in Asia [25]. This groundbreaking work demonstrated that stable artificial infections in epidemiologically relevant malaria vectors are feasible, and that *P. falciparum* can be inhibited by *Wolbachia* within its natural vector. If the severe fitness effects induced by *Wolbachia* in *Anopheles* can be overcome [25], then this approach is highly promising.

The work by Bian and colleagues [25] dramatically enhances the prospect for the use of *Wolbachia* in a malaria control strategy, but many questions still remain. What are the effects of *Wolbachia* on the other four species of *Plasmodium* parasites that infect humans? How relevant are transient infection models? Do some strains of *Wolbachia* enhance pathogens in a field context? What are the long-term evolutionary consequences of novel *Wolbachia*-host associations on *Plasmodium* development within the insect host? What are the mechanisms behind pathogen interference and enhancement of *Wolbachia* on *Plasmodium* parasites, and are the mechanisms of enhancement seen in rodent and avian model systems relevant to human malaria parasites? How influential are environmental variables on pathogen inhibition phenotypes? While many of these questions may be difficult to answer in the short term, assessing the relevance of transient infections would seem within the grasp of the scientific community. Although challenging, understanding the evolutionary consequences of novel *Wolbachia* associations on pathogen transmission and identifying the mechanisms behind *Wolbachia* modulation of *Plasmodium* is critical for developing effective control strategies and assessing their long-term feasibility. Insights from non-Anopheline systems where *Wolbachia* naturally infects the vector may be useful in this regard [16,31,39].

In conclusion, *Wolbachia*-based control of vector-borne pathogens is a promising novel strategy that has many advantages over other conventional and contemporary control methods. The development of a stable infection in *Anopheles* means the prospect of *Wolbachia*-based control of malaria can now be entertained [25], but many important questions need to be resolved before this idea can become a reality. While the concerns raised here focus on *Plasmodium*, these issues are relevant for *Wolbachia* control of any vector-borne pathogen [18]; we suggest that transinfected mosquitoes intended for release into nature should be assessed for inhibition (or lack thereof) of all relevant pathogens circulating in the system.

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Wolbachia infection in wild mosquitoes (Diptera: Culicidae): implications for transmission modes and host-endosymbiont associations in Singapore

Huicong Ding†, Huiqing Yeo† and Nalini Puniamoorthy*

Abstract

Background: *Wolbachia* are intracellular bacterial endosymbionts found in most insect lineages. In mosquitoes, the influence of these endosymbionts on host reproduction and arboviral transmission has spurred numerous studies aimed at using *Wolbachia* infection as a vector control technique. However, there are several knowledge gaps in the literature and little is known about natural *Wolbachia* infection across species, their transmission modes, or associations between various *Wolbachia* lineages and their hosts. This study aims to address these gaps by exploring mosquito-*Wolbachia* associations and their evolutionary implications.

Methods: We conducted tissue-specific polymerase chain reaction screening for *Wolbachia* infection in the leg, gut and reproductive tissues of wild mosquitoes from Singapore using the *Wolbachia* surface protein gene (*wsp)* molecular marker. Mosquito-*Wolbachia* associations were explored using three methods—tanglegram, distance-based, and event-based methods—and by inferred instances of vertical transmission and host shifts.

Results: Adult mosquitoes (271 specimens) representing 14 genera and 40 species were screened for *Wolbachia*. Overall, 21 species (51.2%) were found positive for *Wolbachia*, including five in the genus *Aedes* and five in the genus *Culex*. To our knowledge, *Wolbachia* infections have not been previously reported in seven of these 21 species: *Aedes* nr. *fumidus*, *Aedes annandalei*, *Uranotaenia obscura*, *Uranotaenia trilineata*, *Verrallina butleri*, *Verrallina* sp. and *Zeugnomyia gracilis*. *Wolbachia* were predominantly detected in the reproductive tissues, which is an indication of vertical transmission. However, *Wolbachia* infection rates varied widely within a mosquito host species. There was no clear signal of cophylogeny between the mosquito hosts and the 12 putative *Wolbachia* strains observed in this study. Host shift events were also observed.

Conclusions: Our results suggest that the mosquito-*Wolbachia* relationship is complex and that combinations of transmission modes and multiple evolutionary events likely explain the observed distribution of *Wolbachia* diversity across mosquito hosts. These findings have implications for a better understanding of the diversity and ecology of *Wolbachia* and for their utility as biocontrol agents.

Keywords: *Wolbachia*, *Wolbachia* surface protein gene, Reproductive endosymbiont, Tissue-specific polymerase chain reaction, Transmission modes, Host-endosymbiont association

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Background

Wolbachia are intracellular endosymbiotic bacteria that alter host reproduction [1]. They are widespread in arthropods, infecting a wide range of insect, crustacean, and nematode species [2, 3]. In some cases, *Wolbachia* exist in a mutualistic relationship with their hosts [4–6]. However, *Wolbachia* are most often recognised as reproductive manipulators that bias the sex ratio of the host offspring towards the production of more infected females [7, 8]. This reproductive manipulation is commonly achieved through four phenotypes—male killing [9], feminisation [10, 11], parthenogenesis [12, 13], and cytoplasmic incompatibility [14, 15]—which increase the endosymbiont's reproductive success [16]. Owing to their strong influence on host reproduction, an increasing amount of research is being dedicated to exploring the impacts of reproductive endosymbionts on host population dynamics and evolution [17, 18], especially in medically important insects such as mosquitoes. The promising use of *Wolbachia* to alter both mosquito reproduction [19] and arboviral transmission [20] has prompted the deployment of novel *Wolbachia*-infected mosquitoes for population replacement and suppression [21].

Several countries, including Singapore, have started to employ *Wolbachia* as biocontrol agents of mosquitoes by releasing infected mosquitoes [22–24]. However, the presence of naturally occurring endosymbionts in wild mosquito populations has not been adequately assessed. The release of mosquitoes artificially infected with *Wolbachia* might have a profound impact on closely interacting wild mosquito populations through various transmission modes. For instance, horizontal transmission of an introduced *Wolbachia* strain may result in manipulation of the reproductive biology of non-target species, which could potentially result in an unintentional population crash, opening up niches for other vector species [25]. Another possible effect of this type of biocontrol method is the increased likelihood of co-infections with other naturally occurring *Wolbachia* strains or other endosymbionts, such as *Cardinium*, *Rickettsia*, and *Spiroplasma*. These co-infections may result in a synergistic effect on mosquito host fitness and future transmission of endosymbionts [26–29]. Without a detailed characterisation of *Wolbachia* prevalence and diversity among wild mosquitoes, the ecological risk of releasing artificially infected mosquitoes might be overlooked. Therefore, bearing the precautionary principle in mind, it is important to investigate the natural occurrences of *Wolbachia*.

There is also a need to discern the main mode of infection transmission among mosquitoes. Although *Wolbachia* are mainly thought to be vertically transmitted [15, 30], there have been accounts of horizontal transmissions into wild populations through parasitism [31, 32], or through proximity to infected individuals [33]. *Wolbachia* may not be strictly localised in germline tissues, as they have also been detected in somatic tissues such as the gastrointestinal tract and haemolymph [34–36]. The detection of *Wolbachia* in the gastrointestinal tract suggests that they could be horizontally transmitted through uptake from the environment or host sharing [34, 37, 38], whereas their detection in non-gastrointestinal somatic tissues, such as those of jointed appendages, could indicate horizontal bacterial genome integration into the host genome [36]. Currently, detection of *Wolbachia* in mosquitoes is mostly achieved through conventional polymerase chain reaction (PCR) methods using DNA extracted from an entire individual or its abdomen [39–47]. This limits our ability to identify the site of endosymbiont infection within an individual (tissue tropism). Tissue-specific screening of *Wolbachia* is necessary to provide insights and infer the extent of vertical and horizontal transmission.

It has been proposed that host mitochondrial DNA (mtDNA) and *Wolbachia* are maternally co-transmitted within the cytoplasm [17, 48], which suggests a congruency between host mtDNA and *Wolbachia* phylogenies—a consequence of cytoplasmic hitchhiking driven by endosymbiont transmission [17]. In insect systems such as bedbugs where vertical transmission has been established to be the main mode of transmission, *Wolbachia* exhibit clear patterns of cophylogeny with their hosts, with few instances of host shifting or multiple infections within a single host species [49, 50]. In contrast, cophylogeny is not apparent among nematodes and bees, and numerous acquisitions of *Wolbachia* infections through horizontal transmission as well as losses have been shown in these diversified host lineages [51, 52]. The modes of *Wolbachia* transmission among mosquitoes have not been well established, nor has the extent of multiple infections within mosquito hosts or host shifting of these bacteria.

There is presently no comprehensive analysis of the evolutionary associations between *Wolbachia* and their mosquito host species. An understanding of host-endosymbiont associations will not only further our ability to discern the mode of transmission which influences *Wolbachia* diversity, but will also allow for an evaluation of *Wolbachia* host specificity, speciation, and their ability to establish in new hosts. All of this is key to understanding the diversity and ecology of *Wolbachia*, and their utility in biocontrol methods.

This study has three major research objectives. First, to examine the prevalence and diversity of *Wolbachia* among wild mosquitoes from Singapore. Second, to determine the tissue tropism of *Wolbachia* infection

in mosquitoes using a tissue-specific PCR screening method. Finally, to reconstruct the evolutionary associations between *Wolbachia* and their mosquito hosts to provide a basis for an understanding of host-endosymbiont evolution.

Methods

Adult mosquito collection and identification

Mosquito samples were collected from 12 localities across Singapore between March 2018 and November 2019 (Fig. 1a). Three methods were employed to collect the samples: CO_2-baited Centers for Disease Control and Prevention traps, sweep-netting using hand-held fan traps, and larval sampling [53]. For the latter, dipping was carried out at streams and ponds and pipettes were used to collect larvae from various microhabitats, including tree holes, plant axils, and artificial containers. Thereafter, the field-collected larvae were reared to adults in an incubator maintained at 26 °C and 70% relative humidity, under a 12:12-h (day:night) photoperiod. Larvae were fed with pulverised fish food (TetraMin Granules) daily. Mosquitoes were identified using relevant taxonomic keys and descriptions [54–59]. A subset of individuals from commonly sampled species was selected and preserved in phosphate-buffered saline solution at – 80 °C for subsequent dissection step.

Tissue-specific dissection

Tissue-specific dissection was carried out on each adult mosquito sample to isolate the leg, gut, and reproductive tissues (Fig. 1b–d). To prevent the contamination of tissues with bacteria on the external surface of the mosquito, the leg was removed first before isolating the gut and reproductive tissues. All dissection equipment and microscope slides were thoroughly wiped with 70% ethanol before commencing dissection of the next sample. Dissected tissues were individually placed into a 96-well plate on ice to prevent DNA degradation.

DNA extraction, PCR amplification, and sequencing

DNA extraction of each dissected tissue was performed using 7 µl of QuickExtract DNA Extraction Solution (Lucigen, Madison, USA) in a thermocycler (Eppendorf, Hamburg, Germany) with the following protocol: 65 °C for 18 min, followed by 98 °C for 2 min, ending with cooling on ice for at least 10 min. All dissected tissues were screened for *Wolbachia* infections following single-primer PCR protocols described by Martin et al. [26] with slight modifications to the cycle conditions. The *Wolbachia* surface protein gene (*wsp*) general primers, wsp81F (5′-TGGTCCAATAAGTGATGAAGAAAC TAGCT-3′) and wsp691R (5′-AAAAATTAAACGCTA CTCCAGCTTCTGCAC-3′), were used in this study [60]. In addition, a fragment of the cytochrome c oxidase subunit I (*cox*1) gene of the mosquito hosts was also amplified using primers LCO1498 (5′-GGTCAACAA ATCATAAAGATATTGG-3′) and HCO2198 (5′-TAA ACTTCAGGGTGACCAAAAAATCA-3′) [61]. This served to confirm host identity and acted as an internal control. We used DNA from known *Wolbachia*-infected *Nasonia* specimens as positive controls for this study.

All PCR procedures were performed in reaction mixtures consisting of 12.5 µl of GoTaq G2 Green Mastermix (Promega, Madison, USA), 1 µl of 1 mg ml^{-1} bovine

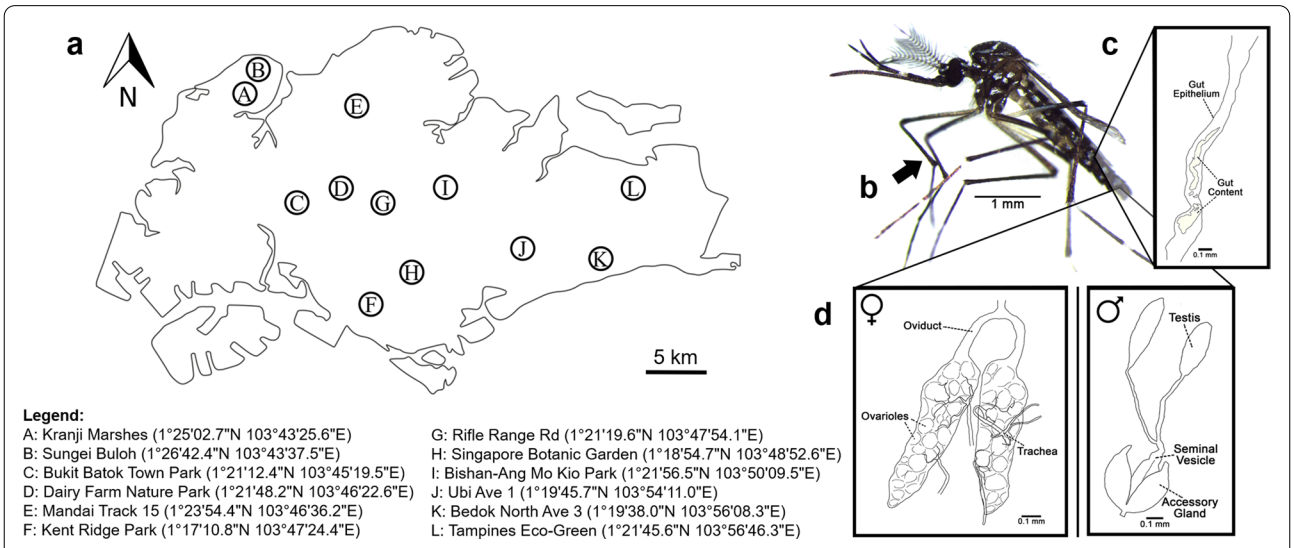

Fig. 1a–d Map of sampling sites and diagrammatic images of *Aedes aegypti* and its dissected tissues. **a** Various mosquito collection localities across Singapore and their respective coordinates, **b** mosquito leg, **c** gut, **d** female reproductive tissue (*left*) and male reproductive tissue (*right*)

serum albumin, 0.184 µl of 25 mM magnesium chloride, 1.5 µl of extracted DNA, and 1.5 µl each of 5 µM *wsp* forward and reverse primers for *Wolbachia* PCR screens or 1.0 µl each of 5 µM LCO1498 and HCO2198 primers for *cox*1 PCRs. Double-distilled water was used to top up the reaction mixture to a final volume of 25 µl. PCR amplification of positive and negative controls was also conducted simultaneously.

PCR conditions were as follow: 94 °C for 5 min, followed by 35 cycles of 95 °C for 30s, 55 °C for 45s, and 72 °C for 1 min, with a final elongation step of 72 °C for 10 min. Amplicons were separated by gel electrophoresis on 2% agarose gel stained with GelRed (Biotium, Fremont, USA) and visualised under a ultraviolet transilluminator (Syngene, Cambridge, UK). PCR products were purified using SureClean Plus (Bioline, London, UK) following the manufacturer's protocol. Samples were sequenced by First Base Laboratories (Axil Scientific, Singapore), using a 3730XL DNA Analyzer (Applied Biosystems, Waltham, USA). Obtained sequences were edited and aligned using Geneious Prime (version 2019.2.3) (https://geneious.com). Similarities with publicly available sequences were assessed using the Basic Local Alignment Search Tool (BLAST) [62].

Statistical analyses

To test if there were significant differences in *Wolbachia* infection across the different mosquito tissues, Cochran's Q-test was carried out. As a follow-up, McNemar's post hoc test was employed to identify the tissue pairs that differed significantly in infection. Individuals for which the internal control (*cox*1 gene) was not amplified successfully for any of the three dissected tissues were excluded from this statistical analysis. The effect of sex on host infection was also tested using binary logistics regression with sex as a categorical dependent variable and infection outcome as a binary independent variable. Logistic regression was conducted on a subset that only included species that had a roughly similar representation of both sexes, i.e. for every species included, the number of individuals of the less common sex was proportionally at least 60% of the number of individuals of the more common sex. This was to prevent a biased analysis due to a dataset with unequal representation of the sexes. Statistical significance was determined as $P < 0.05$. All statistical analyses were performed in R version 3.6.2 [63] with packages nonpar [64], rcompanion [65], and ISLR [66].

Sequence analyses

Multiple alignment of consensus sequences was carried out using the ClustalW algorithm with default settings (gap penalty = 15, gap extension penalty = 6.66) [67], in software MEGA X [68]. Mosquito *cox*1 sequences generated in this study were aligned with 61 reference *cox*1 barcodes of identified local mosquitoes from Chan et al. [53]. For *wsp* sequences, the generated sequences were aligned with 54 available *wsp* sequences of known *Wolbachia* strains obtained from GenBank [69]. Short sequence reads (< 500 base pairs) were excluded.

Neighbour-joining (NJ) phylogenetic trees for mosquito hosts and *Wolbachia* were reconstructed using the sequenced *cox*1 gene fragment and the *wsp* gene, respectively. *cox*1 sequences from previous publications were not included because a comparison of the genetic relationships between the hosts was not the aim of this research. Instead, 54 *wsp* sequences from GenBank were included in the construction of the *Wolbachia* NJ tree. The NJ tree reconstruction was performed with the Kimura two-parameter model as the nucleotide substitution model in MEGA X [68]. Internal gaps were treated as indels and terminal gaps as missing for *wsp* sequences. Bootstrap probabilities were estimated by generating 1000 bootstrap replicates. We designated two biting midge species, *Culicoides asiana* (KJ162955.1) and *Culicoides wadai* (KT352425.1), as outgroups for the host NJ tree construction. Due to the lack of an appropriate endosymbiont outgroup [51], the *Wolbachia* NJ tree was midpoint rooted.

When possible, *Wolbachia* strains were classified into supergroups and putative strains using 97% bootstrap probability as a threshold [60]. *Wolbachia* surface protein sequences that did not have 97% bootstrap support were evaluated on a case-by-case basis. For example, sequences which clustered closely together and had a relatively high support value (> 90%) were deemed as originating from the same putative strain.

Putative strains which were infectious to only one host species were categorized as 'specialists' and those which infected two or more hosts as 'generalists'. Then, the standardised phylogenetic host specificity (SPS) score of each generalist strain was calculated by adapting the method outlined by Poulin et al. [70] and Kembel et al. [71]. SPS measures the degree of phylogenetic relatedness among host species infected by the same endosymbiont strain. It also tests for significance by comparing it with null models generated with 999 replicates of random host-endosymbiont associations. A positive SPS value with a high *P*-value ($P > 0.95$) indicates a high degree of host flexibility where *Wolbachia* infect hosts which are phylogenetically even. A negative SPS value with low *P*-value ($P < 0.05$) suggests a low degree of host flexibility where the infected hosts are phylogenetically clustered together. SPS scores were calculated using R package picante [71].

Evolutionary analyses of the mosquito-*Wolbachia* relationship

Three distinct methods were used to explore the evolutionary associations between mosquito hosts and their *Wolbachia* endosymbionts. The analyses were carried out using pruned phylogenies where each species is represented by a single individual.

First, using the software TreeMap 3.0 [72], a tanglegram was created between host and endosymbiont NJ trees to visualise mosquito-*Wolbachia* associations. A tanglegram is useful as a pictorial representation of the interactions between two phylogenies [73]. TreeMap also seeks to minimise the entanglement between the two trees to provide a clearer visualisation of the phylogenetic relationship between host and endosymbiont [72].

Second, ParaFit Global test, a distance-based method, was employed to quantitatively estimate congruence between the host and endosymbiont phylogenetic trees by comparing genetic distances among infected host species and the *Wolbachia* strains [74]. The null hypothesis for this test states that the associations between host and endosymbiont trees are random, whereas the alternative hypothesis suggests that there are strong associations between hosts and parasites, which are indicated by phylogenetic distances. Significance was tested by comparing the observed associations between host and endosymbiont with randomised associations generated with 5000 permutations. The respective host-endosymbiont associations which contributed significantly to the ParaFit Global statistics were also identified by performing a Parafit Link test. ParaFit tests were performed with the Cailliez correction to correct for negative eigenvalues generated [75] using R package ape [76].

Third, an event-based analysis was performed in Jane 4.0 [77] to map out potential evolutionary events of the endosymbiont in relation to the host phylogeny [78]. Five evolutionary events were considered: co-speciation (host and endosymbiont speciate simultaneously), duplication (intra-host speciation), duplication with host shift (endosymbiont host shifts), loss (host speciates but endosymbiont fails to establish in one of the new lineages), failure to diverge (host speciates and endosymbiont remains in both lineages). As each event is expected to have differing likelihoods, default cost values were attached to each of the events. Jane 4.0 determined the best reconstruction of evolutionary events by minimising the overall cost. The following cost-scheme regime was used with 100 generations and a population size of 300: co-speciation = 0, duplication = 1, duplication with host shift = 2, loss = 1, and failure to diverge = 1 [79]. As a follow-up, random tip mapping (randomisation of host-endosymbiont associations) was carried out for 50 iterations, to determine if the overall cost of reconstruction was significantly lower than expected by chance. If 5% or fewer of the random solutions have costs lower than the reconstructed coevolution phylogeny, there is support for the coevolution of the hosts and endosymbionts through co-speciation.

Results

Prevalence of *Wolbachia* in wild-caught mosquitoes

A total of 271 adult mosquitoes, representing 40 species and 14 genera, were collected from 12 localities in Singapore (Fig. 1a). Overall, infection prevalence was moderate with 119 out of 271 (43.9%) individuals screening positive for *Wolbachia* (Table 1). In total, 21 (51.2%) species were positive for *Wolbachia*. According to our knowledge, *Wolbachia* infection in seven of these species is reported here for the first time (Table 1). *Wolbachia* were detected in all genera except for *Aedeomyia*, *Anopheles* and *Mimomyia* (i.e. 11 out of 14 genera; 78.6%). Five out of the seven *Aedes* species collected (71.4%) were positive for *Wolbachia*, while in the genus *Culex*, five out of 16 species (31.3%) were positive. Some of the screened species in the genera *Aedes* and *Culex* that were positive for *Wolbachia*, such as *Aedes albopictus* and *Culex quinquefasciatus*, are medically important vector species.

The infection rates varied across the mosquito species. Notably, there was variation in the percentage of infection between species that are epidemiologically related. For instance, *Wolbachia* infection was not detected in *Aedes aegypti*. However, infection was moderately high (56.8%) for *Aedes albopictus*. There was also a difference in the infection rate of two closely related species, *Culex pseudovishnui* (86.4%) and *Culex vishnui* (0%) [53].

Locality did not seem to play a role in the *Wolbachia* infection of mosquito hosts. Among species that have a wide range across Singapore, the percentage of infection was consistent in populations across different habitats. For example, the infection percentage was consistently high for *Cx. pseudovishnui*, while consistently low for *Malaya genurostris*. Based on our results, species identity was a better predictor of infection status than locality.

Based on a data subset containing 153 individuals (45.8% males) representing 12 mosquito species, sex was a significant explanatory variable, and there was a significantly lower infection prevalence in males than females (odds ratio 0.434; binary logistics regression: $Z = -2.48$, $df = 151$, $P = 0.013$).

Tissue tropism of *Wolbachia* infection in mosquitoes

Among the 159 successfully amplified *cox*1 sequences, *Wolbachia* infection was mainly observed in the reproductive tissues. Among the reproductive tissues of 159 dissected individuals, 42.1% ($n = 67$) were infected. Percentage infection was lower in the gut (5.7%, $n = 9$) and leg (3.1%, $n = 5$) tissues. The difference in

Table 1 Percentage infection of *Wolbachia* in 40 mosquito species collected from 12 Singapore localities

Mosquito species	Localities												Total	Infection (%)	Supergroup
	BN	BA	BB	DF	KR	KJ	M	RR	SBG	SBL	T	U			
Aedeomyia catastica	–	0/1	–	–	–	–	–	–	–	–	–	–	0/1	0.0	–
Aedes aegypti	0/1	–	–	–	–	–	–	–	–	–	–	0/13	0/14	0.0	–
Aedes albolineatus	–	–	–	–	–	–	0/3	–	–	–	–	–	0/3	0.0	–
Aedes albopictus	–	–	–	6/10	6/10	3/6	6/11	–	–	–	–	–	21/37	56.8	A, B
Aedes annandalei[a]	–	–	–	–	3/4	–	8/9	–	–	–	–	–	11/13	84.6	A
Aedes nr. *fumidus*[a]	–	–	–	–	–	–	–	–	–	6/10	–	–	6/10	60.0	A
Aedes gardnerii	–	–	–	–	–	–	1/1	–	–	–	–	–	1/1	100.0	A
Aedes malayensis	–	–	–	1/2	13/16	0/2	–	–	–	–	–	–	14/20	70.0	A
Anopheles barbirostris complex	–	–	–	0/2	–	–	0/2	–	–	–	–	–	0/4	0.0	–
Anopheles lesteri	–	–	–	–	–	0/2	–	–	–	–	–	–	0/2	0.0	–
Anopheles sinensis	–	0/12	–	–	–	–	–	–	–	–	–	–	0/12	0.0	–
Armigeres kesseli	–	–	–	–	3/3	–	–	–	–	–	–	–	3/3	100.0	B
Coquillettidia crassipes	–	–	–	2/2	6/7	4/4	–	–	–	–	–	–	12/13	92.3	B
Culex (*Lophoceramyia*) spp.[c]	–	–	–	–	0/1	0/2	1/9	–	–	–	0/2	–	1/14	7.1	B
Culex bitaeniorhynchus	–	–	–	–	0/1	–	–	–	–	–	–	–	0/1	0.0	–
Culex brevipalpis	–	–	–	0/1	–	–	0/2	–	–	–	–	–	0/3	0.0	–
Culex nigropunctatus	–	–	–	–	–	0/1	0/2	–	–	–	–	–	0/3	0.0	–
Culex pseudovishnui	–	–	–	–	11/12	–	4/4	–	3/5	1/1	–	–	19/22	86.4	B
Culex quinquefasciatus	–	5/8	–	–	–	–	–	–	–	–	–	–	5/8	62.5	B
Culex sitiens	–	–	–	–	–	–	–	–	–	2/4	–	–	2/4	50.0	B
Culex sp.	–	–	–	–	–	–	0/2	–	–	–	–	–	0/2	0.0	–
Culex tritaeniorhynchus	–	–	–	–	–	2/5	–	–	–	0/1	0/1	–	2/7	28.6	UC[b]
Culex vishnui	–	–	–	–	–	–	0/2	–	–	–	0/3	–	0/5	0.0	–
Malaya genurostris	–	–	2/4	–	0/1	4/13	–	–	0/1	–	–	–	6/19	31.6	B
Mansonia dives	–	–	–	–	–	–	0/2	–	–	–	–	–	0/2	0.0	–
Mansonia indiana	–	–	–	–	–	3/3	–	–	–	–	–	–	3/3	100.0	B
Mimomyia luzonensis	–	–	–	–	–	0/1	–	–	–	–	–	–	0/1	0.0	–
Tripteroides sp.	–	–	–	–	0/7	–	½	–	–	–	–	–	1/9	11.1	UC[b]
Uranotaenia obscura[a]	–	–	–	2/4	–	–	2/2	1/1	–	–	–	–	5/7	71.4	A
Uranotaenia sp.	–	–	–	1/2	–	–	–	–	–	–	–	–	1/2	50.0	A
Uranotaenia trilineata[a]	–	–	–	–	–	–	1/1	–	–	–	–	–	1/1	100.0	B
Verrallina butleri[a]	–	–	–	–	–	1/1	–	–	–	–	–	–	1/1	100.0	UC[b]
Verrallina sp.[a]	–	–	–	–	–	–	–	1/5	–	–	–	–	1/5	20.0	UC[b]
Zeugnomyia gracilis[a]	–	–	–	1/2	–	–	1/13	1/4	–	–	–	–	3/19	15.8	B
Total	0/1	5/21	2/4	13/25	42/62	17/40	25/67	3/10	3/6	9/16	0/6	0/13	119/271	43.9	

BN Bedok North Avenue 3, *BA* Bishan-Ang Mo Kio Park, *BB* Bukit Batok Town Park, *DF* Dairy Farm Nature Park, *KR* Kent Ridge Park, *KJ* Kranji Marshes, *M* Mandai Track 15, *RR* Rifle Range Road, *SBG* Singapore Botanic Garden, *SBL* Sungei-Buloh, *T* Tampines Eco-Green, *U* Ubi Avenue 1

[a] Species in which, according to our knowledge, *Wolbachia* infection has not been previously reported

[b] *Wolbachia* infections that were unclassified (*UC*) with respect to supergroup [60] because their DNA sequences were either too short (< 400 base pairs), or there were alignment issues during the phylogenetic analyses

[c] *Culex* (*Lophoceramyia*) comprises seven unique species, which were not identified here

percentage infection across the three dissected tissues was statistically significant (Cochran's Q-test: $Q = 109.5$, $df = 2$, $P < 0.0001$). The percentage of infection in the reproductive tissues was significantly higher than in the gut (McNemar's post hoc test: $P < 0.0001$) and leg tissues (McNemar's post hoc test: $P < 0.0001$), but the difference in percentage of infection between the gut and leg tissues was not significant (McNemar's post hoc test: $P = 1.0$). Notably, the amplicon size of *wsp* in the gut and leg tissues tended to be shorter than 400 base pairs.

Wolbachia diversity among mosquito fauna from Singapore

Following Zhou et al. [60], all *wsp* sequences obtained in this study can be broadly classified into A and B *Wolbachia* supergroups. Out of 21 infected species, six were infected with supergroup A, ten with supergroup B, and one species, *Ae. albopictus*, was infected with both supergroups (Fig. 2). Infection of the remaining four species (*Culex tritaeniorhynchus*, *Tripteroides* sp., *Verrallina butleri*, and *Verrallina* sp.) was unclassified due to short sequences (< 400 base pairs) or sequence alignment issues during sequences analyses. The analysed *wsp* sequences were also clustered into 12 putative strains: 'Wol 1' to 'Wol 12'. Four (Wol 1, Wol 2, Wol 3, and Wol 8) out of the 12 putative strains could be matched to previously typed strains [60, 80]. *Wolbachia* strains from this study are also closely related to those isolated from other insect groups (Fig. 2). For instance, Wol 9 and Wol 10 are closely related to the *Wolbachia* strains harboured by *Drosophila* spp. (bootstrap value > 99%).

Host specificity of *Wolbachia* strains

The degree of host specificity varied across the 12 putative strains. Seven out of the 12 strains (Wol 2, Wol 4, Wol 5, Wol 6, Wol 8, Wol 10, and Wol 12) were considered as specialists. These strains were host specific and were only detected in one host species each (Fig. 3). The remaining five strains were considered as generalists as they were found in more than one host. Amongst the generalists, Wol 3 was found in the highest number of host species, i.e. three, *Coquillettidia crassipes*, *Mansonia indiana*, and *Culex sitiens*. The SPS scores revealed that Wol 1 had the lowest degree of host flexibility (SPS test: $Z = -1.41$, $P = 0.049$). Wol 7 had the highest degree of host flexibility, but this was not statistically significant (SPS test: $Z = 0.07$, $P = 0.779$) (Table 2).

Evolutionary relationship between mosquitoes and *Wolbachia*

We recorded 18 counts of mosquito-*Wolbachia* associations in wild-caught mosquitoes from Singapore. A visualisation of these associations using a tanglegram showed patterns of broad associations (Fig. 3). For instance, the clade which consists of *Aedes* species was observed to be mostly associated with *Wolbachia* supergroup A. In contrast, other species, especially the clade representing various *Culex* species, had numerous associations with *Wolbachia* supergroup B.

The distance-based quantitative test showed that mosquito and *Wolbachia* phylogenies were weakly congruent at the global level (ParaFit Global test: ParaFit Global = 0.006, $P = 0.048$). Among the numerous

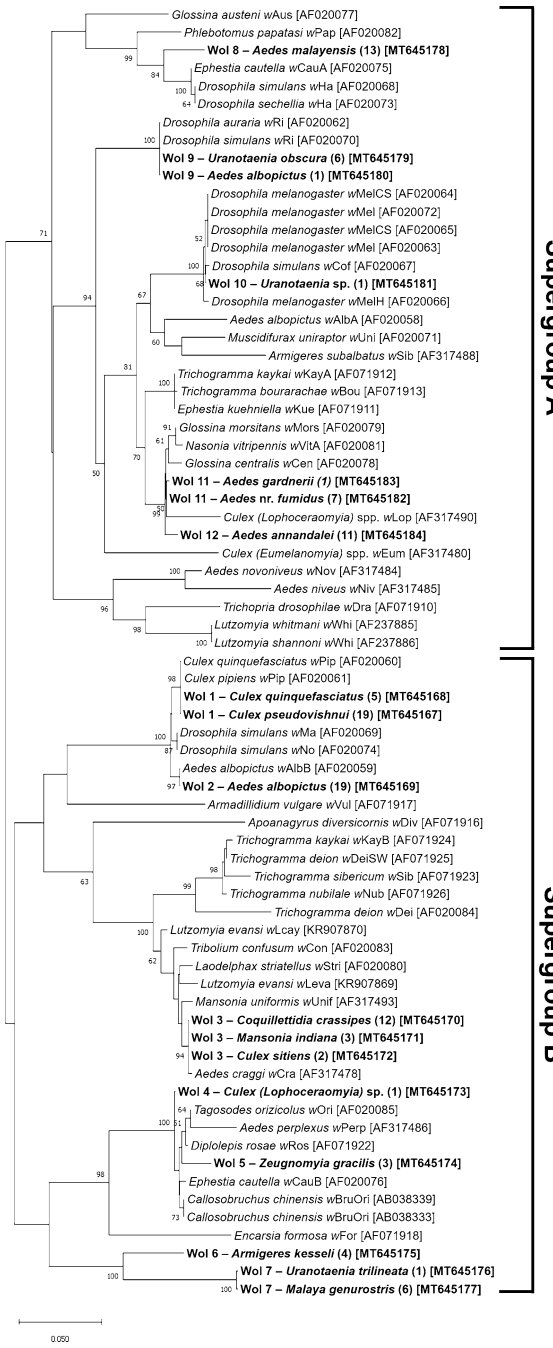

Fig. 2 *Wolbachia* neighbour-joining (NJ) tree constructed with the *Wolbachia* surface protein gene (*wsp*). All analysed sequences generated from this study (*bold*) were broadly classified into *Wolbachia* supergroups A or B and clustered into 12 putative strains ('Wol 1'–'Wol 12'). The number of sequences of each putative strain is indicated *within parentheses*. Also included are 54 sequences obtained from GenBank. Taxa are labelled as the host from which the *Wolbachia* strain was isolated, followed by the strain name. The NJ tree was mid rooted due to a lack of appropriate outgroups [45]. Bootstrap probability (generated with 1000 replicates) higher than 50% is indicated on the tree. Genbank accession number of each sequence is indicated *within brackets*

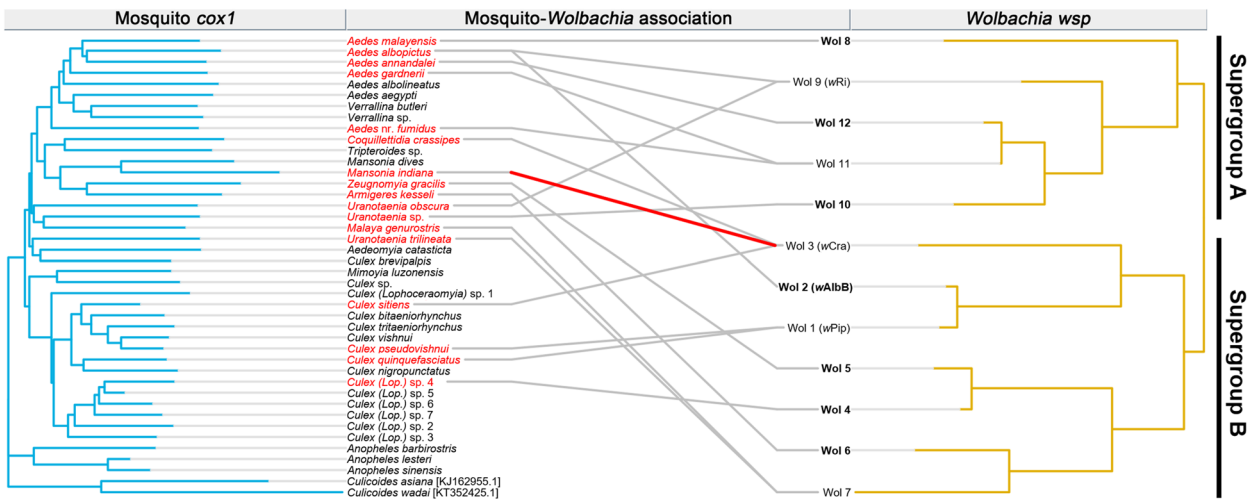

Fig. 3 Tanglegram of mosquito *cox*1 NJ tree compared to the *Wolbachia* endosymbiont NJ tree. Mosquito host species that harboured *Wolbachia* infection are indicated in *red*. Specialist *Wolbachia* strains are in *bold*. *Grey lines* represent the associations between hosts and endosymbionts. A *red line* indicates the host-endosymbiont association that was significant in the Global ParaFit test of congruence between host and endosymbiont phylogenies (Parafit Link test: ParaFit Link = 0.045, $P = 0.029$)

Table 2 Standardised phylogenetic host-specificity (*SPS*) scores of putative *Wolbachia* generalists

Putative *Wolbachia* strain	No. of infected hosts	Phylogenetic host-specificity score	SPS score	*P*-value
Wol 1	2	0.281	− 1.41	0.049*
Wol 3	3	0.391	− 0.162	0.421
Wol 7	2	0.281	0.068	0.779
Wol 9	2	0.281	− 0.234	0.249
Wol 11	2	0.281	− 0.817	0.157

* $P < 0.05$

host-endosymbiont links, only the association between *Mansonia indiana* and Wol 3 was statistically significant (ParaFit Link test: ParaFit Link = 0.045, $P = 0.029$) (Fig. 3).

The event-based analysis between mosquito and *Wolbachia* phylogenies resulted in a reconstructed output of one co-speciation event, three counts of duplication, seven counts of duplication with host shift, 29 losses, and six counts of failure to diverge, amounting to a total cost of 52 (Fig. 4). Interestingly, the number of duplications with a host shift and losses was much greater than co-speciation events. Notably, multiple host shift events tend to follow after loss events occurring earlier in the evolutionary history of the endosymbiont. For example, we see instances of consecutive host shifts to new hosts that were not previously infected (Fig. 4, red arrows). Additionally, based on random tip mapping, 14% of the random solutions had lower costs than the reconstructed output. Overall, there was support for multiple host shift events and losses of *Wolbachia* among the mosquitoes, and no clear signal for mosquito-*Wolbachia* cophylogeny.

Discussion

Detection of *Wolbachia* infection and distribution in wild mosquitoes

In this study, the PCR-based *Wolbachia* screening method had a high positive detection rate with 86.3% of all sequenced amplicons having successful BLAST matches to *Wolbachia*. This suggests that the conventional PCR method used is adequate for *Wolbachia* detection. Even if the study had been carried out without the additional DNA sequencing step, observed amplicon bands would likely have indicated true positives.

Our results indicate that *Wolbachia* are widespread across members of the family Culicidae. To our knowledge, *Wolbachia* infections have not been previously reported in seven of the mosquito species collected in this study. Overall, the percentage infection of screened individuals was 43.9%, which was largely congruent with percentages reported in past studies from the Oriental region, i.e. 31% infection in Malaysia [81], 26.4% in Sri Lanka [39], and 61.6% in Thailand [82]. At the species level, previous studies reported *Wolbachia* infection in 40% of all tested mosquito species in India [83], 18.2% in Sri Lanka [39], 51.7% in Taiwan [84], and between 28.1% and 37.8% in Thailand [82, 85]. Our study showed that 51.2% of all tested species were infected with *Wolbachia*,

Fig. 4 Least-cost evolutionary reconstruction between mosquito (*black*) and *Wolbachia* (*blue*) phylogenies achieved using Jane 4.0. In total, one co-speciation event (*open circle*), three counts of duplication (*grey dot*), seven counts of duplication with host shift (*black dot* with an *arrow* pointing outwards), 29 losses (*dotted line*), and six counts of failure to diverge (*squiggly line*) were mapped out. *Red arrows* indicate periods where multiple host shifts occurred in succession

which is generally higher than the percentage reported in most studies. This was likely due to the broad range of species tested, including those from the genera *Malaya*, *Verrallina*, and *Zeugnomyia* [85]. It is also possible that infection prevalence may vary across geographical regions.

Wolbachia detection in three medically important mosquito genera, *Culex*, *Anopheles*, and *Aedes*, was highly consistent with that of past studies. These genera are responsible for the transmission of vector-borne diseases such as filariasis, malaria and arboviral diseases [86]. Within the genus *Culex*, *Wolbachia* infection has been reported to be variable across its member species [39, 46, 82, 84]. In this study, infections were observed only in five out of 16 *Culex* species. We noticed moderately high *Wolbachia* infection in *Cx. quinquefasciatus* (62.5%), which is a member of the *Culex pipiens* complex responsible for the transmission of filariasis in Singapore [86, 87]. Surprisingly, no *Wolbachia* infection was observed in *Cx. vishnui*–which has been found to harbour Japanese encephalitis virus in Southeast Asia [89]–although it is closely related to *Cx. pseudovishnui* [88] in which the rate of *Wolbachia* infection was high. However, studies in India and Thailand showed a reverse pattern, with *Wolbachia* infection present in *Cx. vishnui* but not in *Cx. pseudovishnui* [39, 85]. As the two species are morphologically similar [53], DNA barcoding was conducted to aid morphological identification, and thus avoid any misidentification. The results lend further support to possible variation in infection prevalence between geographically distant populations.

We did not detect *Wolbachia* in any of the wild-caught *Anopheles* species (18 individuals representing three species), many of which are potential malaria vectors [86]. This is largely consistent with previous reports from different countries [39, 90, 91]. The absence of *Wolbachia* in *Anopheles* mosquitoes is thought to be due to the unsuitability of *Anopheles* reproductive tissues for *Wolbachia* establishment [84, 85]. However, there have been recent reports of *Wolbachia* detected in wild *Anopheles* mosquitoes from West Africa [42, 92, 93] and Malaysia [94]. Knowledge of natural *Wolbachia* infections in *Anopheles* mosquitoes is important for malaria control strategies [93], hence more wild-caught *Anopheles* samples should be screened in Singapore to determine more accurately their infection status.

Wolbachia were not detected in *Ae. aegypti*, the primary vector of dengue in Southeast Asia [87]. Conversely, *Wolbachia* infection was moderately high in the secondary vector *Ae. albopictus*. These results are highly consistent with those of past studies, which reported an absence of infection in wild *Ae. aegypti* [21, 95], but found stable infection in wild *Ae. albopictus* [96]. Although *Ae. aegypti* and *Ae. albopictus* belong to the same subgenus, *Stegomyia*, and occupy similar ecological niches [97], they are rarely found in the same locality, [43, 98, 99], as also observed in this study. This could imply a certain degree of competitive exclusion between the two species, preventing them from occupying the same space. There is evidence that symbionts may influence a host's resource acquisition and specificity, which may ultimately lead to competitive exclusion between closely related host species with differing symbiont infections [100, 101]. However, research on *Wolbachia*-induced competitive exclusion is scarce except for a few studies on heterogonic gall wasps [102], grasshoppers [103], and gall-inducing aphids [104]. Given the widespread influence of *Wolbachia*, future research should explore potential cases of *Wolbachia*-induced competitive exclusion between closely related species of mosquitoes as this may have major implications for an understanding of their symbioses and speciation.

Additionally, although *Ae. aegypti* is frequently artificially infected with *Wolbachia* for biocontrol purposes [105–109], our findings suggest that infected *Ae. aegypti* might not be stably maintained in the wild. This may be advantageous for vector population suppression as the cytoplasmic-incompatibility effect of any artificially introduced *Wolbachia* strain will likely be fully manifested in the uninfected native population [21]. However, this also implies that this type of biocontrol method may have low long-term effectiveness if the infection cannot be naturally sustained in the wild population. The detection of natural *Wolbachia* infection in wild *Ae. aegypti*, therefore, has huge implications for vector control programmes [21]. Not only does it inform the selection of a suitable *Wolbachia* strain prior to its field release, but it can also be used to gauge the long-term effectiveness of a specific vector control programme.

Interestingly, the sex of the mosquitoes had an effect on their *Wolbachia* infection status. This could be an artefact of various *Wolbachia*-induced reproductive phenotypes, such as parthenogenetic and male-killing ones, resulting in offspring that are largely female [15]. If this were true, over multiple generations with vertical *Wolbachia* transmission, one should observe an increasing proportion of females that are infected. Hence, the phenomenon observed here could be a consequence of reproductive manipulation by *Wolbachia* and vertical transmission.

While we were unable to statistically test for the effects of locality on infection status due to uneven and small sample sizes of the respective species across different localities, our results suggest that mosquitoes found in localities across Singapore have roughly equal chances of harbouring *Wolbachia*. This also suggests that underlying physiological factors and phylogenetic relatedness in mosquitoes contribute more to their infection by *Wolbachia* than the habitat in which they are found.

The reproductive effect of *Wolbachia* can be masked or enhanced by other reproductive endosymbionts such as *Cardinium*, *Rickettsia*, and *Spiroplasma* [7, 26–29]. Unfortunately, we were unable to detect these

endosymbionts due to a high degree of false positives with the PCR-based screening methods used here (Additional file 1). This was likely due to using primers that are not optimised for screening mosquito-specific endosymbionts [110–112]. As a result, co-infections with various reproductive endosymbionts, which would have provided greater insights into the synergistic effects of co-infections on mosquito evolution, could not be identified among the wild mosquitoes examined here. There is, hence, a need to develop and optimise alternative screening methods, such as multilocus sequence typing (MLST) techniques, especially for the detection of *Cardinium*, *Rickettsia*, and *Spiroplasma* in mosquitoes.

Tissue tropism of *Wolbachia* infection in mosquitoes

Wolbachia were detected mainly in the reproductive tissues, which agrees with results from studies across multiple insect groups [15, 84, 113], and suggests that *Wolbachia* are mainly vertically transmitted. Interestingly, through the course of this study, there was significant variation in reproductive traits (testis and ovary length) across and within species. These reproductive traits did not vary significantly with *Wolbachia* infection status, even after accounting for phylogenetic relatedness (see Additional file 2).

Infection in the gut and leg tissues was detected, albeit infrequently. This is not surprising, as previous studies have also detected *Wolbachia* in those tissues [34–36, 114]. Interestingly, the nucleotide sequences from gut and leg infections tend to be shorter in length. Considering that *Wolbachia* are unlikely to survive extracellularly for a long period of time [35], the small amplicon size suggests potential horizontal integration of the *Wolbachia* genome into the host genome for a few species. This phenomenon has been observed in several *Wolbachia* hosts [115, 116], and mosquito species such as *Ae. aegypti* and *Cx. quinquefasciatus* [117, 118]. A recent study showed that horizontal integration of the *Wolbachia* genome into the host genome can have implications for sex determination and evolution. This is evident in the common pillbug *Armadillidium vulgare*, and results in the formation of a new sex chromosome [119]. Researchers have also proposed that horizontal gene transfer between an endosymbiont and host can result in evolutionary innovation where new functional genes arise in both host and bacteria [117, 118].

Future research should explore the relative importance of each transmission method with relation to host-endosymbiont ecology and evolution. Tissue-specific screening methods such as those used here can be used in other arthropods, especially when the mode of transmission is not clear. Currently, most *Wolbachia* screening is conducted on ground specimens or specimens in their entirety [39–41]. In these cases, researchers are unable to determine tissue tropism of *Wolbachia* infection, which could provide clues to its mode of transmission. Thus, adopting tissue-specific screening methods would enable researchers to verify or refute the commonly reported assumption that *Wolbachia* is transmitted vertically [15, 30].

Diversity and host-specificity of *Wolbachia* strains

Not only does the *wsp* molecular marker allow successful detection of *Wolbachia* infection across numerous taxa, it also enables strain genotyping and evolutionary comparison between detected *Wolbachia* strains [60]. In this study, *Wolbachia wsp* sequences were clustered into 12 putative *Wolbachia* strains falling within supergroup A or B. This is consistent with the results of previous studies that looked at *Wolbachia* infections in mosquitoes [39, 80, 85]. Each mosquito host species was only infected by strains belonging to supergroups A or B, with the exception of *Ae. albopictus*, which harboured both. Infection with more than one strain (superinfection of wild *Ae. albopictus* with *Wolbachia* supergroups A and B) has been previously reported, and this phenomenon was commonly observed to be fixed in the examined populations due to strong cytoplasmic incompatibility effects [120, 121]. This suggests stable vertical transmission of both strains in *Ae. albopictus*. Additionally, only four out of 12 putative strains were identified as previously typed *Wolbachia* strains reported by Zhou et al. [60] and Ruang-Areerate et al. [80]—Wol 1, Wol 2, Wol 3, and Wol 8 were identified as *w*Pip, *w*AlbB, *w*Cra, and *w*Ri strain, respectively.

Host specificity is thought to be a characteristic of the ancestral *Wolbachia* strain, with host flexibility reported mainly in *Wolbachia* supergroups A and B [122]. In our study, we found a combination of specialists and generalists, with more of the former. A study of mosquitoes from Taiwan showed a similar pattern [84]. In beetles, a mixture of *Wolbachia* supergroup A host-specific and host-flexible strains within a population has also been reported [49]. While our estimates of specialists and generalists might vary with greater sampling effort, the higher numbers of specialists observed can be explained by the process of reciprocal selection between host and endosymbiont over evolutionary time [123]. This is also known as Red Queen dynamics, where the endosymbiont constantly adapts to its host to ensure continued establishment in the same host [124]. An alternative, generalist strategy can also be maintained in a population. It ensures survival in an environment where resources (i.e. hosts) are rarely found [123]. However, there are generally more instances of

host specialists than generalists across numerous parasitic and endosymbiotic taxa [125–127].

The SPS scores revealed that host flexibility among the generalists varied greatly. Understanding *Wolbachia* host specificity has huge implications, especially for the optimisation of *Wolbachia* biocontrol strategies. Not only should researchers select strains that can effectively limit pathogen replication [128], they should also select strains for their host specificity. This is not possible without the screening of a wide variety of species or closely related species, which was achieved in this study. Using a host-specific strain will decrease the likelihood of host shift to non-target species, and thereby minimise the overall ecological risk of a strategy.

Evolutionary relationships between mosquitoes and *Wolbachia*

Host-*Wolbachia* relationships are often understudied and limited to a few taxa [52]. Studies have shown that the evolutionary associations between *Wolbachia* and their insect hosts do vary across taxa [49–52, 129]. Likewise, our exploratory analyses of mosquito hosts and their *Wolbachia* infection support such a complex relationship, with neither co-speciation nor host shifting fully accounting for evolutionary association in these lineages.

Based on the tanglegram, a broad association pattern between mosquitoes and *Wolbachia* strains was observed (Fig. 3). *Aedes* mosquitoes tended to be associated with *Wolbachia* supergroup A, while other mosquito species, particularly of the genus *Culex*, were largely associated with *Wolbachia* supergroup B. This showed that closely related *Wolbachia* strains are likely to establish themselves in related hosts. There might have been radiation of *Wolbachia* in these clades after their respective initial establishment. Nevertheless, the observed variations in host-endosymbiont associations make us question the mosquito-*Wolbachia* association pattern.

The ParaFit analysis showed weak support for congruency between host and endosymbiont phylogenies. Among the 18 host-*Wolbachia* associations, only the link between *Mansonia indiana* and Wol 3 showed a significant association (Fig. 3). This was interesting considering that Wol 3 was largely host flexible. Given that this was the only significant association, it is worth carrying out further genus-specific study on *Mansonia* spp. to elucidate coevolutionary patterns within a group of closely related mosquito species. It is possible that the degree to which *Wolbachia* co-evolve with their mosquito hosts varies across different taxonomic levels [74]. The analyses carried out thus far suggest that mosquito-*Wolbachia* associations are likely random at higher taxonomic levels, and that mosquito-*Wolbachia* co-speciation occurs at finer phylogenetic resolution (i.e. similar to patterns seen in diffuse coevolution).

The event-based analysis performed in Jane 4.0 (Fig. 4) indicated that co-speciation events were infrequent as compared to other evolutionary events. We noticed a greater proportion of host shifts and numerous losses. Interestingly, the least cost coevolutionary reconstruction indicated multiple consecutive host shifts occurring near the tips of the cladogram. This suggests that co-speciation does not fully explain the evolutionary associations between mosquito hosts and *Wolbachia*. Instead, recent host shifting through horizontal transmission seems to promote *Wolbachia* diversification. This lends greater support to the idea that horizontal transmission between distantly related species is possible [32, 33, 130].

Furthermore, losses, which represent endosymbiont extinction events that occurred upon host speciation, seem to dominate the evolutionary history of *Wolbachia*. Extinction events are believed to be frequent in host-endosymbiont systems [123], due to either evolution of resistance in the host or declining host population size, which result in the inability of highly specialised endosymbionts to establish themselves [131, 132]. Additionally, losses could potentially influence endosymbiont evolution through the creation of vacant niches [131]. The observed losses followed by host shifts in the mosquito-*Wolbachia* relationship are possible consequences of vacant niche exploitation by generalists. Perhaps this enabled successful endosymbiont invasion due to minimal intra-strain competition. If this were true, horizontal *Wolbachia* transmission and losses may play a bigger role in accounting for *Wolbachia* diversity than previously thought.

As this was an exploratory study, we were unable to determine the exact mechanism behind the diversity and evolutionary associations of *Wolbachia*. The presence of numerous specialists could be a sign of mosquito-*Wolbachia* coevolution since coevolution is fundamentally reciprocal selection between host and endosymbiont which gives rise to micro-evolutionary changes [133]. The numerous host shifts and losses might have, however, blurred the effects of vertical transmission over a long evolutionary period [52]. Thus, co-speciation might have occurred within smaller clades of *Wolbachia* and mosquitoes, but at higher taxa levels, horizontal transmission and loss events are more likely the prominent force driving *Wolbachia* evolution.

Strengths, limitations, and future directions

The three distinct methods employed here to explore evolutionary associations have both strengths and limitations. The tanglegram allows for clear visualisation of host-endosymbiont association without taking into

account any evolutionary relationships, but there have been calls for careful interpretation of the results generated using this method as the degree of entanglement may not necessarily represent phylogenetic congruence [134]. The Global ParaFit test seeks to address this limitation by testing for global congruency with an unbiased, statistical approach [74]. The event-based method enables the evaluation of potential evolutionary events that might have occurred throughout an endosymbiont's evolutionary history such as co-speciation, duplication, and host shifting. This last method, however, cannot fully differentiate a topological congruence from an evolutionary event [135]. Without knowledge of the time of divergence for both symbiont and host, a co-phylogenetic pattern may be better explained by ecological factors (as compared to co-speciation) given that bacterial lineages often evolve faster than their hosts [136, 137], and the high likelihood of host shifts among closely related species [133].

The *Wolbachia wsp* gene has been shown to provide well-resolved phylogenies [60], and this study provides an exploratory snapshot of the evolutionary associations between mosquito hosts and their *Wolbachia* endosymbionts. There is, of course, a potential caveat, since only a single gene was used to construct the respective phylogenetic trees. To obtain a more accurate phylogeny, future studies could adopt MLST [17, 51], or whole-genome shotgun sequencing [52]. The former could potentially characterise putative *Wolbachia* strains that cannot be distinguished with *wsp* gene primers.

Notwithstanding their limitations, the employment of various analytical methods allows for a comprehensive examination of the evolutionary associations between *Wolbachia* and mosquito hosts which are presently lacking in the literature. The scope of future studies that examine the evolution of medically important vector species could be narrowed to the Aedini tribe, as this would provide greater statistical power for the examination of mosquito-endosymbiont associations.

Conclusion

To our knowledge, this is the first study to examine *Wolbachia* infections in wild mosquitoes in Singapore. We detected 12 putative strains of *Wolbachia* among 40 mosquito species, and recorded infections in seven species for which, to our knowledge, *Wolbachia* infections have not been previously reported. By employing a tissue-specific PCR screening method, we were able to observe that the *Wolbachia* infections were preferentially located in the reproductive tissues, which provides support for vertical transmission as the main mode of infection transmission. However, even if *Wolbachia* infection is mainly transmitted vertically, this is unlikely to fully explain the observed diversity of *Wolbachia* and why closely related *Wolbachia* lineages were found in distantly related mosquito species. Hence, this study also served as an exploratory study which examined mosquito-*Wolbachia* evolutionary associations across a wide range of host mosquito species through three evolutionary analyses. Overall, we propose that the evolutionary associations between mosquito hosts and *Wolbachia* are consequences of both vertical and horizontal transmission and various evolutionary events.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s13071-020-04466-8.

Additional file 1: Table S1. Polymerase chain reaction (PCR) screening of *Cardinium*, *Rickettsia*, and *Spiroplasma* in wild mosquitoes from Singapore.

Additional file 2: Figure S1. Weighted reproductive tissue length across various mosquito species.

Abbreviations

BLAST: Basic Local Alignment Search Tool; *cox*1: Cytochrome c oxidase subunit I gene; MLST: Multilocus sequence typing; mtDNA: Mitochondrial DNA; NJ: Neighbour joining; PCR: Polymerase chain reaction; SPS: Standardised phylogenetic host specificity; *wsp*: *Wolbachia* surface protein gene.

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Authors' contributions

HY and NP designed the research. HD and HY collected the mosquitoes from the field. HY identified the mosquito samples. HD performed the DNA extraction and PCR. HD and HY carried out the sequence analyses. HD, HY, and NP interpreted the results and wrote the manuscript. All the authors read and approved the final draft of the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during this study are available in the Dryad repository, https://doi.org/10.5061/dryad.zs7h44j63. Sequence data that support the findings of this study have been deposited in Genbank with the accession codes MT645167–MT645184.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Publisher's Note

From:	Marcelle Liana
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 : DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai
Date:	Tuesday, March 7, 2023 8:02:28 PM

Aloha

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Mahalo,

Marcelle Liana

From:	Mary Livingston
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Tuesday, March 7, 2023 12:28:08 PM

ALoha,

I DO NOT ACCEPT the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

The scope, risks, and experimental nature of the plan requires detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

I demand an Environmental Impact Statement. (EIS).

I personally cannot stand mosquitos, they like me too much.
I am even less favoring of tampering with nature.
Please do not make this mistake.

Sincerely,

Mary Livingston

From: La‘akea Low
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] March 10, 2023 Meeting: Item K1
Date: Wednesday, March 8, 2023 11:46:36 PM

Aloha mai,

Providing written testimony in opposition to Agenda Item K1 to be reviewed at the March 10, 2023 BLNR meeting.

The 2014 BLNR misspent 400,000 taxpayer dollars when they entered into an MOU with KOA to cover half the cost of planning and permitting for the proposed project.

For a project that many communities vehemently oppose, it makes the 1000x increase in State funding outlined in the most recent MOU - an astronomical 4,560,000 dollars - seem short-sighted at best and tone-deaf at worst.

Extravagantly priced band-aids that only serve to benefit off-shore hoteliers, while adversely affecting multi-generational families and multi-millenia ecosystems are nowhere near the most prudent use of public funds.

Support would not be in question for a project that truly addresses the environmental, economical, and social impacts related to the inevitability of sea-level rise.

While this project aims to artificially re-create beachfronts not seen since the 1980s, perhaps the best way to move forward into the 21st century would be to cut the State's $400,000 in losses and invest future millions in more innovative sea-level rise mitigation projects.

After all, lineal-descendants of the area have steadfastly testified in previous BLNR meetings that this project is similar to TMT, whereby communities of all colors and creeds will do everything in their power to halt the proposed destruction and desecration of ko lākou one hānau.

A hiki i ke aloha ‘āina hope loa,

La‘akea Low

From: Sara Lowell
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written Comment on Agenda Item C.2- Stopping Hawaii's Bird Extinctions
Date: Monday, March 6, 2023 2:17:17 PM

To whom it may concern;

I am writing to express my strong support for DLNR's propose program to stop the threats posed on Hawaii's prized endemic forest birds by avian malaria. Drastic times call for drastic measures and the Incompatible Insect Technique (IIT) can suppress mosquito populations and help save our native forest birds. We know that avian malaria, which is driven by the climatic shifts caused by a human induced climate change, is a death sentence for our native honeycreepers. We hope that not only will this program be rolled out, but rolled out in the swiftest of timelines. These birds have a ticking time bomb facing them, and every day that passes is a day that more birds can become infected.

Thank you for to the State of Hawaii, DLNR, and the programs partners for taking this ambitious and cutting edge approach to stopping extinction.

Sara Lowell
Kauai

From: Bonnie Lykes
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Environmental Statement Demand
Date: Tuesday, March 7, 2023 5:36:51 AM

I am opposed to the planned biopesticide mosquito releases on Maui, and want an Environmental Impact Statement. There are serious risks, and the outcome is admittedly unknown.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS). I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

From: sunnivamaguire@aol.com
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2
Date: Wednesday, March 8, 2023 9:40:35 PM

Aloha
I am opposed to this mosquito release plan and for an Environmental Impact Statement.

We have seen in the past that foreign or lab leaked ticks, viruses, bacteria or importing species like mongoose and gecko where they do not belong has been very problematic even disastrous.
We cannot possibly in advance know the long term effects of these actions or what releasing lab-reared mosquitoes infected with Wolbachia bacteria will lead to.
It is possible it could spread diseases like avian malaria and West Nile virus and have adverse health effects on birds and humans.

Historically man has not been very adept at playing God.
One can question corporations and scientific institutions motivations when attempting to do so.

The eco systems here are sensitive and fragile
and we cannot proceed without being able to know with certainty there are no irreversible negative effects on insects, animals or humans down the line.
We need an Enviromental Impact Statement, any other decision is absurd.

Mahalo for your time,
S Maguire

From: Holly Malloy
Cc: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Re: Testimony OPPOSED to BioPesticide Mosquito Release on Maui
Date: Wednesday, March 8, 2023 10:05:26 PM

I am absolutely opposed to this experiment which may have unknown detrimental repercussions to both wildlife and human populations. I understand the intention, however this is a dangerous and unnecessary approach.

Sincerely,

Holly Malloy

Sent from my iPhone

> On Mar 8, 2023, at 9:01 PM, kevin hoeke <kevinhoeke@hotmail.com> wrote:
>
> Im a CA environmental attorney and its obvious to me that this project requires the highest level of environmental evaluation and documentation.
>
> totally inadequate thus far.
>
> this is a novel project in this ecosystem
>
> risks are huge
>
> more evaluation!!
>
> Thank you,
>
> Kevin
>
> Law Office of Kevin Hoeke
> SBN 157935
> P.O. Box 44
> Soquel, CA 95073
> 831.421.1072
> www.hoekelaw.com

From: Spirit <swaroop@spiritofaloha.org>
Sent: Wednesday, March 8, 2023 2:56 PM
To: blnr.testimony@hawaii.gov <blnr.testimony@hawaii.gov>
Subject: Testimony OPPOSED to BioPesticide Mosquito Release on Maui

Aloha,

My name is Fredrick Swaroop Honig, I have served as the director of the Spirit of Aloha Nature Sanctuary in Haiku for almost 30 Years.

We are an official National Wildlife Federation Sanctuary.

We are adamantly OPPOSED to the planned biopesticide mosquito releases on Maui and we

request that a full Environmental Impact Study be completed. We have more endangered birds In Hawaii than in all other 49 states combined. The Potential risks to our endangered birds outweighs the possible benefits. We can demonstrate for you ways that we have successfully an organically controlled mosquito populations with urns of mosquito eating guppies that are natural to all the streams of Hawaii.

May our beloved Mother Maui & all of her inhabitants be protected from these serious risks & unknown outcomes!

Would you please confirm that you have received & registered our written testimony? Thank you! Please let us know if you would like to visit and see how we are controlling Mosquitos naturally,

Respectfully Submitted,

Mahalo Nui Loa,

Fredrick Swaroop Honig
Gardens' Trustee
Phone: 808.572.2300
www.spiritofaloha.org

From:	JoAnna
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Testimony re: C-2 (3/10/23)
Date:	Wednesday, March 8, 2023 10:20:40 AM

Aloha board members and attendees,

I am writing to express my support of the Wolbachia program to reduce mosquito populations in Hawai'i.

I feel strongly that this program should be implemented as soon as possible because if action isn't taken immediately we risk losing our native forest birds completely. Wolbachia is a scientifically supported solution with proven results. It's not an experiment, it's been safely used with good results in other places like California, Texas, Mexico, and Australia to stop the spread of mosquito-borne diseases that sicken humans. In fact, 15 different countries, including the continental U.S. have used Wolbachia to decrease mosquito populations. It's natural, non-GMO, and safer than pesticides. There is a lot of misinformation floating around but Wolbachia doesn't hurt people, or animals that eat mosquitoes, or change the water supply in any way. Wolbachia is already in the environment—nature healthily coexists with all kinds of bacteria, we even need them in our gut to help digest food.

Mosquitoes are not native and do not belong in Hawai'i. Additionally, no native species depend on them for food. They are, in fact, a plague on native wildlife. It is vital we fix this situation because the extinction of multiple species of birds, known only to exist here in Hawai‘i, hinges on humans making the right decisions and doing the right things to correct the mistakes we ourselves have caused to this unique and fragile ecosystem we call home. Humans brought mosquitoes to Hawai‘i in the 1800s and we have to be the ones to do the work to get rid of them now.

We cannot dismiss the immediacy of this crisis. There is no recovery from extinction. Hawaiian honeycreepers are facing challenges and this is an area we can truly help have a positive impact. Do we really want to wake up one morning and hear the news that we have lost the last ‘i‘iwi? How will we feel if we can only describe them to our youngest family members and know they'll never see one for themselves because they are all gone? How will we feel if we know we missed a chance to save them?

Our native birds attract tourism dollars for our economy but more importantly, they are valuable to Hawaiian culture, Hawaiian history, and Hawaiian identity. We should celebrate them because they are precious, inspiring, stunning, and they only exist here in these magnificent islands. They need our help and we will surely regret not meeting these challenges with decisive action if they disappear forever.

One of the most beautiful things about our species is our indefatigable ability to solve complex problems and this comes into no greater light than we fix the problems we ourselves created. By reducing mosquito reproductive rates by implementing the Wolbachia bacteria plan we will see less mosquito larvae squiggling in the puddles. That's a win for birds and a solid win for us!

Thank you sincerely for your time,

Joanna Maney

From:	Peace Kanuna Mano
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 9:34:41 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement.

The Footsteps to Peace
Peace Kanuna Mano
(808) 769-8168
thefootstepstopeace@gmail.com

From:	Jennifer Marcil
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support for Agenda Item C-2
Date:	Tuesday, March 7, 2023 8:33:49 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT AGENDA ITEM C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.
Honeycreepers such as the Akikiki are unique and found on in Hawai'i.
From the 50 previous species, only 17 are left.
Swift action is needed to reduce avian malaria and give these birds a chance for survival.
The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds.
Please help save our birds.

Mahalo nui,

Jennifer Marcil

Jennifer Marcil
jmarcil@4dmedia.org

From: Serge Marcil
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Share my Mana'o in order to save Kaua"i forest birds
Date: Monday, March 6, 2023 8:35:46 PM

Aloha,

My name is Serge Marcil. I'm a resident of Lihu'e, Kaua'i.

I'm writing this email in support of **Agenda Item C-2** (on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui).

The fate of our honeycreepers is desperate and dire. The numbers speak for themselves. So I have researched the Incompatible Insect Technique online (https://www.worldmosquitoprogram.org, https://www.nature.com/articles/s41586-019-1407-9, etc.). I've discussed it with scientists and biologists (who know far more than I do), and I am now of the opinion that the mosquito control efforts touched upon in agenda item C-2 must be urgently adopted.

Please support this very imporatnt action too, and don't hesitate to contact me if you have any questions or need further information.

Mahalo.

Serge Marcil
(c) 808-212-6473
(e) smarcil@4Dmedia.org

From:	Lea Mariposa
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Subject: OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Tuesday, March 7, 2023 6:39:11 PM

To whom it may concern,

I strongly oppose the DLNR's proposed strategy to prevent Bird Extinctionon Maui and Kaui to release genetically altered mosquitos. An environmental impact study MUST be done in order to insure that more damage than good will be accomplished.

Thank you!

Kim Marzetta
Citizen of Hawaii for 22 years

The present moment is filled with joy and happiness. If you are attentive, you will see it.

~Thich Nhat Hanh

From:	Michelle Melendez
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 4:08:22 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. **I demand an Environmental Impact Statement (EIS).**

Michelle Melendez
Fitness and Wellness Expert Since 1996
Author Of The Best Selling and 4x Award Winning Book,
End Dieting Hell: How to find peace in your body and release the weight
https://blossominnerwellness.com/
Order your copy of End Dieting Hell Click Here

From: THOMAS MILCAREK
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Please, do NOT do this
Date: Tuesday, March 7, 2023 12:57:02 PM

Aloha,

This is NOT a good idea. How many times do we have to do unnatural things like this before we learn we are NOT better than Nature. The terrible situation we are in now is because of past issues where we thought we knew better and introduced unnatural things, things that would never occur in Nature into our environment. Restore the Natural balance, DO NOT create more unnatural imbalance.

Again, PLEASE DO NOT DO THIS.

mahalo,

Thomas Milcarek
68-078 Au St. # 103
Waialua, Hi, 96791
831 227 1919

Native Hawaiian birds are going extinct at an alarming rate. With the highest number of extinctions in the country, Hawaii's native birds are hardest hit by invasive species and habitat loss. Setting aside habitat for these species to thrive in is an important aspect in conserving these species. Native forests are disappearing at alarming rates, with invasive species quickly taking over many of the islands native plants. This is detrimental to conserving Hawaii's biodiversity – such as endangered plants and birds that only exist in these places. With some species of Hawaiian honeycreeper expected to go extinct within the year, it is more important than ever to work to conserve the remaining species. I work with endangered native birds on Kauai, seeing the cultural and ecological importance of each of these species first hand has shown me how important it is to fight against extinction in any way possible. These populations need to be preserved, along with the native forests that they live in. Please take this step in conserving native land!

Another step to be made in preventing extinctions is invasive species eradication. Invasive predators such as feral cats, rats, pigs, and deer all destroy native ecosystems and kill off native birds. Avian-malaria carrying invasive mosquitoes are currently the biggest threat to sustaining native honeycreeper populations. Through the use of Wolbachia, mosquito populations will be drastically reduced, therefore reducing the spread of these devastating diseases. Wolbachia is our last hope of saving these species from extinction, and efforts to implement it's use on all islands need to be acted upon immediately for the best chance of success. I fully support our native ecosystems and species and fully support the use of Wolbachia to aid in achieving conservation goals across the state. These populations of native birds need to be preserved.

Thank you for your time,

Leah Miller

253-376-9492

3327A Puni Rd. Koloa, HI 96756

From: Bret Mossman
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony for Agenda Item C2 March 10, 2023
Date: Thursday, March 9, 2023 6:24:26 AM

Aloha Kākou,

My name is Bret Nainoa Mossman, I am a resident of Panaʻewa in Hawaiʻi Island, and a lineal descendant of the Ahupuaʻa of Nuʻu in East Maui.

I am writing to express strong support of the use of Wolbachia IIT for the suppression of mosquitoes. Many of the cultural practices that native birds once sustained in the Hawaiian Islands have been largely lost due the effects of invasive species particularly by diseases spread by mosquitoes. Wolbachia IIT is the most important action that can be taken to protect native birds. No other management strategy even comes close, and finally after decades of research and testing it is finally available at the scale needed. Please support DLNR and partner agencies in getting this much needed tool deployed as quickly as possible in East Maui, and throughout Hawaiʻi. This is the best chance we have of bringing native birds back from the brink and eventually working towards the restoration of nearly lost cultural practice and tradition.

I am also writing to express opposition to the use of captive care. As a biologist working for the state of Hawaiʻi (these are my views and do not reflect those of any organization that I am affiliated with), I have worked on three different projects that released birds from captive care into the wild. In all of those instances and for all three species nearly every individual died. As a Kānaka these experiences nearly made me leave the field of conservation because as a direct result of the decisions made by some of the same experts cited in the informational report, animals that are sacred, were killed.

Captive care has had a very poor record of success both here in Hawaiʻi and globally. To date there are no examples of a passerine bird brought entirely into captivity being successfully restored to the wild. There have been some successes augmenting wild populations with captive birds and through keeping birds in captivity only during key life stages, but that is not what has or is likely to occur in Hawaiʻi. Previous attempts to keep kiwikiu in captivity did not produce encouraging results. The current captive population of ʻakikiki is also aging, most of the individuals are more than five years of age, and the oldest known wild bird only survived to be between eight and nine. Recent attempts to bring additional ʻakikiki into captivity also resulted in tragedy when after being captured and transported to the captive facility an adult male died. Both kiwikiu and palila, two related honeycreepers, have previously been released from captivity and did very poorly. Both species did not develop typical wild foraging behaviors and quickly succumbed to predators, climate, and disease. Wild translocated counterparts included in these same releases faired much better and continued to exhibit important behaviors. Many of these however flew back to where they were originally sourced (palila) or fell victim to disease (kiwikiu). However one wild male kiwikiu survived for over two years post release, demonstrating just how capable wild birds are at adapting to novel areas and remaining in an area when released.

This observation of the kiwikiu is also consistent with recovery actions for passerines in other island systems. In Aotearoa (New Zealand) one of the most common and successful conservation strategies are translocations. When a subset of individuals from the wild population are moved to an area inside or outside of their historical range where threats have been addressed or are less allowing for them to survive. This has been particularly successful for birds like the Tieke which in 1964 was down to just 36 individuals before they were translocated, and now numbers at ~700 individuals across 11 populations. This method has also been hugely successful here in Hawaiʻi for birds like the Ululu (Nihoa millerbird) and the Nēnē. It was even utilized in the late 1800s at the behest of Queen Liliʻuokalani, who had a small group of Hawaiʻi ʻŌʻō moved from Hawaiʻi Island to Kauaʻi where according to her, grew into a thriving colony by the time she wrote her book (Hawaii's Story by Hawaii's Queen). A likely senario for what could have happened had ʻAkikiki been translocated to Hawaiʻi Island instead of into captive care.

What's preventing this type of action? Primarily laws. In 2011 these same laws prevented the translocation of Nēnē from Kauaʻi to other islands but due to mounting public safety concerns Governor Ambercrombie signed executive action nullifying all state laws that would prohibit the movement of Nēnē from Kauaʻi to Hawaiʻi Island and Maui. Following this action within one year Nēnē began to be translocated to the aforementioned islands, and have significantly aided in their recovery to the point where Nēnē were downlisted in 2019. Critics will point out that it's risky and that there may be limited time; any amount of time that we can give these birds that allows them to remain in native forest even if on another island is far more valuable than time in a cage. Furthermore landscape level Wolbachia IIT is only a few months to a few years away from reality, meaning that birds moved to Hawaiʻi island would also benefit from that management technique before areas are predicted to be impacted by mosquitoes. Similar species to both the kiwikiu and ʻakikiki also live on Hawaiʻi Island, and thanks to ongoing restoration have even been increasing in some protected forests. A group of experts also concluded that there were multiple suitable sites for translocation for the four most threatened birds in Hawaiʻi Island, provoding even more justification for a translocation. Competition between these species is also unlikely given differences is foraging space and in territoriality.

I hope that this board works with the Green administration to move forward with executive action to facilitate translocations for our imperiled forest birds over the tried and often failed approach of captive care.

There is no easy solution, but our native birds are in a state of emergency and they need desperate action if we have any hope of saving them.

Mahalo nui for your time, consideration, and support of our native manu.

Bret Nainoa Mossman

Aloha Chair and Members of the Board,

My name is Dr. Hanna Mounce. I am the coordinator of Maui Forest Bird Recovery Project. I am professionally and academically trained as a biologist and, personally, someone who values our amazing and unique biodiversity in Hawaii. I have been working to prevent the extinction of our native forest birds for the past 17 years.

I would like to speak to agenda item C-2, "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai." I hope that you will find this briefing not only informative but also inspiring and hopeful. There is finally a tool on the horizon that may be able to turn around the trajectory of our rapidly declining native forest birds.

Other than humans ourselves, there is not another introduction in Hawaii that has caused the extinction of more forest birds than this mosquito and the disease that they spread. Avian malaria is a primary contributor to population range limitations, declines, and extinctions for Hawaiian honeycreepers. This is not only a disaster of the past but it is disaster of the present as, fueled by climate change, it continues to overwhelm our remaining forest bird populations.

These looming extinctions and the collapse of the entire forest bird ecosystem is an ecological disaster, as recognized earlier this year. These native birds serve critical ecological functions in our forests as pollinators and seed dispersers for the shrubs and trees that comprise our watersheds. I believe the Wolbachia project proposed is one of the best shots we have to save these remaining birds. The progress that this project has made in the past several years is remarkable and a tremendous example of the best science and large partnerships all coming together to solve this problem.

Rarely do we have a safe and effective tool that so clearly has no significant impacts to anything else in Hawaii.

Mahalo for your time.

H Mounce 03/08/2023

From: Peter Murakami
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Opposition to biopesticide mosquito release
Date: Tuesday, March 7, 2023 5:09:17 PM

I am opposed to the planned biopesticide mosquito releases on Maui, and want an Environmental Impact Statement. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS). I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).
Peter Murakami

From: Pam Murphy
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony of Support for Agenda Item C-2
Date: Tuesday, March 7, 2023 1:46:22 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui.

Honeycreepers are a unique group of forest birds found only in Hawai‘i, which once had more than 50 species. Today, only 17 species remain, some with fewer than 500 individuals left. Without swift action, several species of honeycreepers will become extinct in the next ten years.
As the climate warms, mosquitoes carrying avian malaria are moving upslope into the last refuge for Hawai‘i’s forest birds. The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds.

Please SUPPORT the mosquito control efforts in agenda item C-2.

Mahalo nui!

Pamela Murphy
Kilauea, HI

From:	Nassib Nabaa
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Agenda Item C-2 Preventing the extinction of Kauai forest birds via mosquito control
Date:	Thursday, March 9, 2023 8:43:39 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

The population of Kauai's forest bird has been crashing and is rapidly going extinct due to avian malaria spread by mosquitoes. Urgent action is needed. The proposed conservation actions must be acted upon without delay.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
Nassib Nabaa
Kalaheo, Kauai

The Nature Conservancy
Hawai'i and Palmyra

The Nature Conservancy, Hawai'i and Palmyra
923 Nu'uanu Avenue
Honolulu, HI 96817

Tel (808) 537-4508
Fax (808) 545-2019
nature.org/HawaiiPalmyra

Testimony of The Nature Conservancy
In Support of Agenda Item C-2, "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kaua'i"

Hawai'i Board of Land and Natural Resources
March 10, 2023, 9:15 AM
Kalanimoku Building, 1151 Punchbowl St., Room 132 and via Teleconference

Aloha Chair Chang and Board Members:

The Nature Conservancy (TNC) of Hawai'i is in **support** of the Hawai'i Department of Land and Natural Resources' (DLNR) proposal to prevent the extinction of endangered native forest birds by suppressing populations of the invasive *Culex quinquefasciatus* mosquito on Maui and Kaua'i.

Native Hawaiian forest birds are imperiled by the spread of avian malaria which is carried into their last remaining habitat and transmitted to the birds by invasive mosquitoes. This disease caused waves of extinctions after it was introduced in the early 1900s and the continued impacts have been tracked for decades by researchers and land managers alike.

Historically, pesticide application and management of breeding habitat were the only options for controlling mosquitoes, neither of which are appropriate for controlling mosquitoes in the forest habitat where Hawaii's endemic forest birds persist. But now there is hope with an approach called Incompatible Insect Technique (IIT) which leverages naturally occurring bacteria within the *Culex* mosquitoes and releases of "incompatible" male mosquitoes to suppress *Culex* populations. Note, male mosquitoes are nectar feeders and do not bite humans or wildlife, nor are mosquitoes important for native species or ecosystem function in Hawai'i.

We are excited to have an option for saving our birds from mosquito-borne disease that is safe for animals and humans alike. Decades ago, IIT was developed for agricultural pest and human disease control, and it went through rigorous vetting and regulatory approvals to be applied safely in human inhabited areas. This project is proposing to release incompatible male *Culex* mosquitoes in the remote mountain forests of our islands, starting on Maui. Most people will not even see the released male mosquitoes as they will not interact with humans.

IIT is a good option for disrupting the avian malaria disease crisis imperiling Hawai'i's endemic forest birds: it is specific to only one species of mosquito, it does not introduce toxicants to the environment, and the removal of introduced mosquitoes will not impact the native food web in Hawai'i's forests. Furthermore, this action would not introduce any new organisms to Hawai'i. Wolbachia, the genus of intracellular bacteria naturally occurring in *Culex quinquefasciatus,* prevents reproduction when mating male and female mosquitoes carry incompatible strains.

We agree with DLNR that an Environmental Assessment (EA) is appropriate for this project as there is no significant environmental impact expected associated with IIT suppression of *Culex quinquefasciatus*. TNC is confident that the risks and impacts assessed by DLNR and the National Park Service in the East Maui Mosquito Suppression EA are comprehensive of this project and we encourage you to **support** this strategy.

If we do not take action now, we will see the extinction of multiple native bird species within ten years. TNC, DLNR and many members of Hawai‘i’s conservation community have dedicated significant time and resources to provide safe habitat for Hawai‘i’s native forest birds through management of preserves including fencing, ungulate removal, weed control, native tree restoration, and predator control. Avian malaria vector control through mosquito suppression is the key piece that can reverse the downward population trends our birds are experiencing while keeping them in their forest home. Please **support** this critical and safe initiative before it’s too late for our birds.

Mahalo for your support and stewardship of Hawai‘i’s natural resources.

The Nature Conservancy of Hawai‘i and Palmyra is a non-profit organization dedicated to the preservation of the lands and waters upon which all life depends. The Conservancy has helped protect more than 200,000 acres of natural lands in Hawai‘i and Palmyra Atoll. We manage 40,000 acres in 13 nature preserves and work in over 50 coastal communities to help protect and restore the nearshore reefs and fisheries of the main Hawaiian Islands. We forge partnerships with government, private parties, and communities to protect forests and coral reefs for their ecological values and for the many benefits they provide to people.

From:	Cindy Ogata
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Oppose Agenda Item C2- DLNR"s Proposed Strategy to Prevent Bird Extinction on Maui and Kauai
Date:	Tuesday, March 7, 2023 9:18:02 PM

Subject: **Subject: OPPOSE *Agenda Item C2* : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"**

Testimony:

I DO NOT accept the Environment Assessment's Anticipated Findings of No Significant Impact. My concern is the impact on our native and endangered birds, wildlife, environment and public health. Do we have an environmental impact statement yet?

Cindy Ogata

From: Patrycja Wietrzychowska Ohara
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 6:22:19 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

1. the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

On March 7th, 2023 I went on a hike with my husband to Kaulana Manu Nature Trail hoping to see ‘i'iwi for the first time in my life. I was amazed by the various sounds of different birds, the native forest, it felt like a magical unique experience. And then suddenly we saw a dead ‘i'iwi on the ground right on the trail. We were both shocked and very sad to see this beautiful bird lifeless. It made us realize how real Hawaii's forest bird extinction crisis is. It made us also scared about its impact on the whole Hawai'i ecosystem, it made us worried about the future of our children.

I am a mother of two boys: 6 and 3 years old who are passionate about Hawaiian wildlife. The moments when I see them the happiest are when they are hiking in the forest, climbing trees, hearing nene flying over in the mornings and in the evenings, spotting ‘io on the sky, observing ‘apapane flying between ‘ohi'a trees, playing with the waves in the ocean, watching whales, observing green sea turtles. In their young hearts they feel a deep connection to nature already and it gives them pure joy. It also makes them good and kind people. Nothing else can replace these precious experiences.

Tonight, when I was putting my children to bed, I explained to them that I have one more thing to do before going to sleep. My curious 6 year old son asked what it was. I explained that I want to send my opinion to the decision makers about controlling mosquitos which are killing the native forest birds. My son told me that he is hoping that the decision makers won't leave the mosquito problem to be as it is, because all the native honeycreepers will die. And his words really touched me, because he was right.

So on behalf of my children, I want to ask you to take the proposed conservation actions because they are our best hope at this moment.

Mahalo nui for the opportunity to provide testimony,
Patrycja Ohara

Attachment:

Photo of a dead 'i'iwi found on the ground while hiking in Kaulana Manu Trail on the Big Island, 3/7/2023

From:	Hob Osterlund
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] SUPPORT mosquito control efforts
Date:	Tuesday, March 7, 2023 6:15:25 PM
Attachments:	small - Kauai Albatross Network final logo with website TRANSPARENT copy.png small - Kauai Wildlife Coalition Circle copy.png

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

Hawaiʻi is already the extinction capital of the world, and now we have several bird species on the brink. THERE IS NO TIME LEFT.

The proposed conservation actions have proven to be effective elsewhere in the world for public health issues. WE CANNOT ALLOW MORE SPECIES TO GO EXTINCT ON OUR WATCH.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!

Hob Osterlund, APRN
Senior Fellow, Safina Center
Founder and Bird Guide, Kauaʻi Albatross Network
Author, Holy Mōlī: Albatross and Other Ancestors (multiple printings)
Producer, Telly Award-winning "Kalama's Journey"
Photographer, Audubon Top 100, 2019
Recipient, Koa Conservation Leadership Award, Conservation Council for Hawaiʻi, 2022

From: ascendingstarseed
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2
Date: Tuesday, March 7, 2023 8:07:43 PM

Subject: “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

To Whom It May Concern,

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Mahalo,
Annette O'Toole

From: Ryan Oyama
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C-2 - March 10, 2023 - support
Date: Thursday, March 9, 2023 7:22:00 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources:

I am writing in support of agenda item C-2.

Over the past few decades, appreciation in Hawaii of our native heritage has grown, including the recognition of our unique natural history and ecology. Unfortunately, much of our native ecosystem has already been compromised and many native species have been driven extinct, such as several of our endemic honeycreepers. These birds have cultural significance, are keystone species of our native forests, and are thus crucial for the preservation of our ecosystems and watersheds mauna to makai.

The greatest threat to the remaining honeycreepers is the introduced disease avian malaria, which is spread by the Southern House Mosquito. All mosquito species in Hawaii are invasive but we now have an opportunity to combat these pests with the Incompatible Insect Technique. This safe and proven technique offers hope that we can stop the further loss of our iconic and endemic honeycreeper species and maybe even begin to restore what has been lost. The urgency to act is high as several of these birds are critically endangered and climate change is pushing mosquitos ever higher into our native forests. Failure to act when we finally have a tool and hope would be unconscionable. We must save our native forest ecosystems and with that our watersheds and the sustainability of our island home.

Ryan Oyama
Kalāheo

From: Santino Panico
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2
Date: Wednesday, March 8, 2023 10:59:22 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua'i and Maui.

I believe our extinction crisis ….

I believe the proposed conservation actions….

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!

Santino Panico

From: Jessica Panzer
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Save native birds
Date: Saturday, March 4, 2023 6:24:25 AM

Aloha
As you know hawaii is the extinction capital of the world. We will continue to lose species if hawaii doesn't finally start prioritizing our remaining native species. We need to do everything in our power to save the last remaining native birds. The only way is Wolbachia mosquitos as avian malaria will soon be found even at the highest mountain tops, where these birds have been forced to live to escape that threat. Unless we introduce Wolbachia mosquitoes climate change will finish them off. We need to act now.
Thanks for reading my email.
Aloha,
Jessica Middleton
Kamuela, HI

Sent from my iPhone

From: Denise Park
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Oppose agenda for mosquitoes
Date: Wednesday, March 8, 2023 1:11:37 PM

I oppose the mosquito release agenda.
Thank you, Denise Park

From:	Jesse Parker
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 7:13:29 PM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

-Jesse Parker

From: Arna Parr
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Mosquito release in Hawaii
Date: Wednesday, March 8, 2023 6:52:16 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement(EIS).***

Arna Parr

Sent from my iPhone

From: Deborah Pate
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda item: C. DIVISION OF FORESTRY AND WILDLIFE NON-ACTION ITEM #2.
Date: Tuesday, March 7, 2023 1:12:00 PM

Dear Board Members:
These are my opinions, mana'o regarding the Hawai'i Forest Bird Extinction Crisis. Which is on the agenda under the Division of Forestry and Wildlife.
NON-ACTION ITEM
2. Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to Prevent their Extinction on Maui and Kauai.

I believe that since we are facing an extinction crisis; due to climate change and globalization which is driving our ecosystems to change so quickly and drastically for many species to survive, possibly even ourselves. We need to do what we can to protect – our biological heritage in these islands. The one promising tool we have to protect Hawai'i's forest birds from the devastating effects of avian malaria is the "Incompatible Insect Technique" to interrupt mosquito reproduction, thereby reducing mosquito populations to help stop the decline of these precious birds. It is a clear and safe choice. Fewer mosquitoes means fewer vectors of avian malaria. This approach is currently in use on the U.S. mainland and elsewhere in the world to help suppress mosquitoes that carry human diseases, such as dengue or Zika. It is considered so safe that in some areas, residents have regular packages of male Wolbachia shipped to their home during the mosquito "season." Why are we waiting? This is not a new technique and it is safe! We must protect what is left of these birds in the wild. We need to take action now.
Deborah Pate
4100 Queen Emma's Dr. #37
Princeville, HI 96722

From:	Sara Patton
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Oppose agenda item C2, DLNR's proposed strategy to prevent bird extinction on Maui and Kauai
Date:	Tuesday, March 7, 2023 6:45:28 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).***

From: Eric Perlman
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony re Agenda Item C-2
Date: Wednesday, March 8, 2023 4:33:19 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I have been to Kaua'i and Maui multiple times and I am life long birder and naturalist. The Hawaiian native flora and fauna are uniquely precious, and increasingly precarious with accelerating fallout from climate change and human created impacts on our ecosystems.

I support, Agenda Item C-2 on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauai and Maui.

Further extinction of these rare, exquisite, and unique Hawaiian forest birds is unthinkable and catastrophic. The proposed conservation actions are vitally urgent!

Please supportive mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!

Dr. Eric Perlman
845-750-8890

From: Cornelia Powell
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] environmental impact statement
Date: Tuesday, March 7, 2023 4:26:06 PM

For the safety and health of all residents of Hawaii, we must have an Environmental Impact Statement about this proposed Wolbachia mosquito release.
Please put people's well being before politics and profit.

Thank you.
Cornelia Powell

From: Kiane Prietto
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] LAND BOARD SUBMITTALS TESTIMONY (item C-2)– 03/10/23
Date: Saturday, March 4, 2023 8:02:08 AM

AGENDA
FOR THE MEETING OF THE
BOARD OF LAND AND NATURAL RESOURCES

C. DIVISION OF FORESTRY AND WILDLIFE

DATE: March 10, 2023

TIME: 9:15 A.M.

Aloha nō,

My name is Kiane Prietto and I am from Waimanalo, Oʻahu. I grew up seeing pictures of our native manu but never once seeing one until I moved to Hawaii island in my late 20ʻs. People have shared with me in these small communities of seeing the native birds frequent from mauka to makai. Once the Alala could be heard on the edge of every forest and I grew up without any of those experiences. Our native birds have evolved in isolation over millions of years, resulting in a unique diversity of species found nowhere else in the world. Today they face extinction and along with it will fall our native ecosystems.

Hawaiian native birds include a variety of species of honeycreepers, thruses, doves, and geese. Some of the most well known and iconic species include the Nēnē, ʻIʻiwi, ʻApapane, ʻAkohekohe, etc. Unfortunately, all of these species are threatened and/or highly endangered due to habitat loss, introduced predators, and disease spread by mosquitoes. Please support the current conservation efforts that are underway to protect and restore these unique beautiful birds by any means. Hear what DOFAW has to share in both of their proposed conservation tools: habitat protection through mosquito control using the incompatible insect technique and securing populations of the critically endangered ʻakikiki and kiwikiu in captivity.

Mahalo for taking the time to read through my email.

i lā maikaʻi,

Kiane Prietto
ʻĪnana Program Director

kiane@purplemaia.org

From: Andrea Pro
To: DLNR.BLNR.Testimony; DLNR.Testimony
Subject: [EXTERNAL] Wolbachia program testimony URGENT
Date: Thursday, March 9, 2023 8:48:37 AM
Attachments: ATT00001.png

C-2 to:
Further ways to share your mana'o at:
https://dlnr.hawaii.gov/.../land-board-submittals-03-10-23/
Aloha board members and attendees,
I am a Hawai'i island artist who focuses on telling the story of our endangered birds and forests. Having been involved in re-forestation programs all over the island, I have worked closely with biologists and learned about the heartbreaking state of our native birds. What is even more heartbreaking, and unconscionable, is how little the Hawai'i government has done to reduce threats within the ecosystems that these birds still exist under daily threats from feral cats, mosquitos, ungulates and other invasive species.
I am writing to express my support of the Wolbachia program to reduce mosquito populations in Hawai'i.
I feel strongly that this program should be implemented as soon as possible because if action isn't taken immediately we risk losing our native forest birds completely. Wolbachia is a scientifically supported solution with proven results. It's not an experiment, it's been safely used with good results in other places like California, Texas, Mexico, and Australia to stop the spread of mosquito-borne diseases that sicken humans. In fact, 15 different countries, including the continental U.S. have used Wolbachia to decrease mosquito populations. It's natural, non-GMO, and safer than pesticides. There is a lot of misinformation floating around but Wolbachia doesn't hurt people, or animals that eat mosquitoes, or change the water supply in any way. Wolbachia is already in the environment—nature healthily coexists with all kinds of bacteria, we even need them in our gut to help digest food.
Mosquitoes are not native and do not belong in Hawai'i. Additionally, no native species depend on them for food. They are, in fact, a plague on native wildlife. It is vital we fix this situation because the extinction of multiple species of birds, known only to exist here in Hawai'i, hinges on humans making the right decisions and doing the right things to correct the mistakes we ourselves have caused to this unique and fragile ecosystem we call home. Humans brought mosquitoes to Hawai'i in the 1800s and we have to be the ones to do the work to get rid of them now.
We cannot dismiss the immediacy of this crisis. There is no recovery from extinction. Hawaiian honeycreepers are facing challenges and this is an area we can truly help have a positive impact. Do we really want to wake up one morning and hear the news that we have lost the last 'i'iwi? How will we feel if we can only describe them to our youngest family members and know they'll never see one for themselves because they are all gone? How will we feel if we know we missed a chance to save them?
Our native birds attract tourism dollars for our economy but more importantly, they are valuable to Hawaiian culture, Hawaiian history, and Hawaiian identity. We should celebrate them because they are precious, inspiring, stunning, and they only exist here in these magnificent islands. They need our help and we will surely regret not meeting these challenges with decisive action if they disappear forever.
One of the most beautiful things about our species is our indefatigable ability to solve complex problems and this comes into no greater light than we fix the problems we ourselves created. By reducing mosquito reproductive rates by implementing the Wolbachia bacteria plan we will see less mosquito larvae squiggling in the puddles. That's a win for birds and a solid win for us!

Thank you sincerely for your time,
Andrea Pro

Hawaii Artist and Printmaker
Fine art and shop: andreapro.com
andrea@andreapro.com
808 . 345 .0907

From:	Kelly Pummill
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Testimony in Support of Native Bird Extinction Crisis, Strategy to prevent extinction on Kauai and Maui
Date:	Tuesday, March 7, 2023 2:12:03 PM

Aloha,
Please accept this email as my testimony in support of the proposed strategy to fight the extinction of our native birds on Kaua'i and Maui. I am a long time resident of Kaua'i, and feel it's important to have a voice in support of this important project to save our endangered forest birds.

This is a critical moment where we can take action to combat this crisis that is killing our manu kanahele. If we do nothing the fates of our endangered birds such as the critically endangered 'akikiki here on Kaua'i and the kiwikui on Maui are sealed and the native forest will no longer echo with their sound. That fate may be the fate of all of our native forest birds if we don't take this step now.

These birds are not only a critical part of our ecosystem, as pollinators and seed dispersers in our native forests, but an important part of Hawaiian culture and to our community. As an important part of the watershed ecosystem that brings our communities freshwater, if the forest becomes silent, what will we do then?

Due to climate change, the areas in which these birds still survive is rapidly disappearing and while this may continue until we make bold steps to fight the it, we still have the ability to try to save these birds. The science behind these efforts, the "Incompatible Insect Technique" to combat avian malaria spread by the non-native southern house mosquito, is sound and has been used for many years and around the world to protect the human population from disease. The wolbachia bacteria is naturally occurring and used in this method poses no threat to us or any other species and these introduced mosquitos are not a significant source of food for any other species in Hawai'i .

Why would we not take advantage of this technology to use it in conservation to save our native and endangered forest birds? By giving them a chance to survive and once again fill our forests with song, we are also giving ourselves the opportunity to thrive in a land with plentiful freshwater for our communities.

As a person of indigenous background, the connection we have to our land, water and all that live in it is a part of who I am. It is not separate. It is our responsibility to protect and care for it. While my ancestors are from a different land that was taken from us and I have never been able to experience, that connection is the same no matter where we live in the world. Hawai'i has been my home for over 12 years now, I am connected to it and I will do all I can to help in the effort to save our manu and our 'aina, and believe we all have the shared kuleana to do the same.

The time to start is now, the longer we wait the less time we have to try to save our forest birds!

Mahalo nui loa,
Kelly Pummill
'Ele'ele, HI 96705

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A 'ohe hana nui ke alu 'ia
No task is too big when done together by all

From: Andre Raine
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written testimony in support of Agenda Item C-2
Date: Tuesday, March 7, 2023 4:39:56 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

I have worked on Kauai in conservation for the last 12 years, much of it in the mountains of the north-west of the island. Over that period of time, I have personally watched the decline of these precious endemic forest bird species and areas that were once alive with bird song are now depressingly silent.

The only hope species like the 'akikiki and 'akeke'e have is the control of mosquitoes, otherwise they will go extinct. Its as simple as that. They do not have any time left, so the time to act is now. *Wolbachia* is clearly an important technique to tackle this issue - it targets the mosquitos responsible for the spread of malaria, will not impact on humans, will not impact on any other species, and may be one of the last hopes these birds have.

Therefore, please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui! -Dr Andre Raine

--

Dr. Andre Raine

Science Director,

Archipelago Research and Conservation LLC

PO Box 81

Hanapepe, Kaua'i, HI 96716, U.S.A.
Office Tel: 808-335-5300

From: Juhl Rayne
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] NO to the mosquitos!!!!!!! BLNR 3/10 agenda c2
Date: Monday, March 6, 2023 7:09:48 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

this is INSANITY thinking to bring in these mosquitos....
NOOOOOOOOO< there is NO taking this back if implemented.
thank you,
Juhl Rayne (concerned citizen - Hawaii Island).

From: Kate Reimann
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] March 10 presentation (item C-2)
Date: Sunday, March 5, 2023 6:29:00 PM

Aloha, I'm writing to extend my support for the current proposed, well-researched and well-supported protective measures that the DLNR will be presenting on March 10 regarding the preservation of kiwikiu and akikiki species. My son, Paul Munter Reimann (also submitting testimony) is passionate about preserving the native species on our Hawaiian Islands and his love for these birds has educated dozens of people in a very short time. We fully support the use of Wolbacchia IIT and the collection of viable species to protect and preserve these species into the future — a future where, I hope, we all come to recognize the importance of preserving all of our native species.

Thank you for your time and for helping to save our native birds.

With aloha,

Kate Reimann
248-462-5552

From: Paul Munter Reimann
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Birds Not Mosquitoes Testimony
Date: Sunday, March 5, 2023 6:38:11 PM

Aloha,

My name is Paul and I am a 7th grader at Le Jardin Academy. I am writing to testify for the DLNR's Proposed Strategy to Prevent the Extinction of Hawaii's Forest Birds on Maui and Kauai. I have read the INFORMATIONAL BRIEFING ON THE HAWAII'S FOREST BIRD EXTINCTION CRISIS AND DLNR'S PROPOSED STRATEGY TO PREVENT THEIR EXTINCTION ON MAUI AND KAUAI and believe that this is a viable solution to the current issue. I am an avid birder, photographer, and bird lover and believe in the importance of protecting these birds before it is too late. I really hope to see these birds some day and would be crushed if they went extinct. Thank for your time and I hope you decide to support this measure to save Hawaii's remaining gems.

Thank You

Paul

From: Kim Rogers
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony for Meeting of BLNR on March 10, 2023
Date: Tuesday, March 7, 2023 10:40:31 AM

Aloha e BLNR Chair and Esteemed Members,

I am writing to voice my enthusiastic support for landscape-scale mosquito control in critical forest bird habitat (via a proven safe method known as the Incompatible Insect Technique) to save Hawaii's remaining honeycreepers. This show of support is an acknowledgement of endemic forest birds' critical role in the protection and preservation of our native ʻōhiʻa forests and watershed. Sadly, the loss of these birds would mean yet another loss of Hawaiian culture. We cannot let our forests go silent on our watch.

I also enthusiastically support safeguarding the remaining individuals of wild ʻakikiki and kiwikiu in captivity for release back into their forest habitat once mosquito control is successfully implemented on the landscape.

Saving Hawaii's endemic forest birds is THE conservation crisis of our day—right now, not tomorrow. This is our kuleana. We cannot wait for another generation to fix it. By then, it'll be too late.

If you have questions about these proposed efforts, I highly encourage you to talk to informed scientists and not be misled by the fears of a few misinformed minority.

In full transparency, I work for Kaua'i Invasive Species Committee and these thoughts and testimony are wholly my own.

Thank you for your time.

Mahalo,
Kim

Kim Steutermann Rogers
Anahola, HI 96703

From: Cozette Romero
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written Testimony - Agenda item C-2, 03/10/23
Date: Monday, March 6, 2023 2:34:27 PM

Aloha,

My name is Ashley Romero and I am submitting testimony in strong support of Agenda item C-2.

Hawaii's native Honeycreepers are foundational to the culture, forests, and ecosystems of Hawai'i. We have already lost a great deal of these forest bird species due to avian diseases transmitted by non-native mosquitoes. Every time we lose a bird species we lose an ecosystem service, a valuable part of our community, a beautiful native creature, a unique creation of an incredible number of years of evolution, and a piece of Hawaiian culture. Right this moment one of our native forest birds on Kaua'i 'akikiki is going extinct in the wild. Two native birds on Maui, the kiwikiu and the 'akohekohe are predicted to also go extinct within the next few years if nothing is done **immediately**. As pollinators, seed dispersers, and insect eaters, they are essential for our forests and without action or delayed action, these species have **no chance** of survival.

The incompatible insect technique or mosquito birth control provides us with a last glimmer of hope and opportunity to save the last remaining Honeycreepers from extinction. This method has been used successfully worldwide for vector control for human diseases and gives us a powerful tool to address the main cause for the decline of our Honeycreepers: avian malaria transmitted by the Southern House Mosquito. Neither the disease nor the vector is native to the Hawaiian islands and the mosquitoes have invaded the highest elevation of our island, decimating our Honeycreeper populations every day. Our forest birds evolved in a mosquito-free Hawai'i and a single bite of an infected mosquito can be enough to kill an 'i'iwi.

It is solely the fault of human beings for the declines and extinctions of our native birds. Introducing predators, plants, and disease to these islands has been a death sentence to our native species. If we continue to let native species go extinct, we risk the collapse of our entire ecosystem.

We have the tools to make this situation better and as a professional who grew up in Hawai'i, and has worked in Hawai'i's native forests for over 6 years now, I have seen firsthand the type of dire situation we are in. Please do your part to protect Hawai'i's native bird species, its ecosystems, and its culture and support IIT and other mosquito control techniques. Please support Agenda item C-2.

All the best,

Ashley

From:	Robbie Roosen
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Tuesday, March 7, 2023 4:51:25 AM

This is clearly a malicious attack on our ecosystem.
DLNR has been degrading our AINA for far too long.
Just stop with these destructive programs.
Ke ea o ka Aina does not need your help to be pono.
Aloha,
Robert G. Roosen, PhD
Owner/Director
Rainbow Observatory

From: Loree Searcy
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] I am opposed to C2
Date: Tuesday, March 7, 2023 4:48:09 PM

I do not want to see GMO mosquitoes released into Hawaii as the long term environmental effects and the effects on the human race are not known.
Please perform an EIS study to further evaluate!
I oppose c2.
Mahalo,
Loree Searcy

Sent from my iPhone

From:	Cathrine Sinclaire
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 9:12:21 PM

I am strongly opposed to the ill-considered and potentially catastrophic release of bioengineered mosquitoes (or any other organisms) anywhere in Hawaii.

Remember the brilliant release of mongeese to eradicate rats??? The rocket scientists proposing this idiocy must not be allowed to destroy our islands! An EIS, at the very least, must be done before any release of *any* kind is allowed.

Mahalo,
Cathrine Sinclaire, RN ret.

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From: Mikes Menagerie
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Mosquito EIS demand
Date: Wednesday, March 8, 2023 9:09:50 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Mike Smith
808-769 0280
92- 8960 Bougainvillaea Dr
Captain Cook Hi 96704

From: Bart Smith
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Release of Untested Mosquitos
Date: Saturday, March 4, 2023 5:44:43 PM

Dear BLNR

We have already had the disasters of other creatures like mongeese being released because it seems like a good idea. Before releasing these mosquitos I think it is important that some kind of field testing be done.
I can't help but feel that if no testing is done, then those who allow the release should be personably accountable for the out come.

Respectfully
Dr. Robert B. Smith

From: Olivia Snowden
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda C-2 Support
Date: Wednesday, March 8, 2023 11:00:36 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to protect the remaining populations of honeycreepers from extinction on the islands of Kaua‘i and Maui.

I believe the use of Wolbachia will be effective in suppressing the mosquito populations enough to buy time for a more permanent solution and/or for honeycreepers to build back their populations and give them a chance to develop immunity to avian malaria. Wolbachia mosquito projects have proven successful in many other places across the world, and the 'Akikiki and other honeycreepers on Kaua'i and Maui have no other hope for survival. The significance of these birds to the Hawaiian ecosystems, history and culture of Hawai'i cannot be replaced, and we have the power to prevent this tragedy and take back some of the damage humankind has inflicted on these delicate and beautiful island ecosystems. Help us help the birds.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui.
Olivia Snowden

From: KUPU
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] C-2 Testimony
Date: Wednesday, March 8, 2023 10:58:27 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to protect the remaining populations of honeycreepers from extinction on the islands of Kaua‘i and Maui.

I believe the use of Wolbachia will be effective in suppressing the mosquito populations enough to buy time for a more permanent solution and/or for honeycreepers to build back their populations and give them a chance to develop immunity to avian malaria. Wolbachia mosquito projects have proven successful in many other places across the world, and the 'Akikiki and other honeycreepers on Kaua'i and Maui have no other hope for survival. The significance of these birds to the Hawaiian ecosystems, history and culture of Hawai'i cannot be replaced, and we have the power to prevent this tragedy and take back some of the damage humankind has inflicted on these delicate and beautiful island ecosystems. Help us help the birds.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui.
Olivia Snowden

From: John Stahl
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Hawaii Forest Bird Extinction Crisis
Date: Tuesday, March 7, 2023 10:55:28 AM

To the Members of the Board,

I am writing today to urge your support for efforts to save Hawaii's native bird population from extinction. In particular, I strongly recommend the use of Wolbachia IIT in this effort. It is evident, from the results of peer reviewed studies, that IIT is our best hope in saving this vital part of Hawaiian culture and habitat. Time is short. Incredibly, some of our birds, such as the Akikiki, may even disappear this year. Disappear forever. Modern science and Native Hawaiian practitioners agree that we have run out of time, and that IIT is virtually our only way forward if we are to succeed. The loss of Hawaiian honeycreepers would be a devastating blow to Hawaii, and the world. We all know that these islands are unique, and the birds are a vital, integral part of that. If we lose the birds, we lose Hawaii. Yes, it will be costly, and success is not assured, but it is well worth the expense and effort. It is an investment in our home, and a necessary one.

Please support this effort.

Mahalo,
John Stahl

From: Alyssa
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2
Date: Tuesday, March 7, 2023 5:02:43 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of Wolbachia bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

Thank you,

Alyssa Stamey
castamey@pm.me

From: Tama Starr
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C2: Opposing Mosquito Release
Date: Tuesday, March 7, 2023 7:02:10 PM

Dear Friends at BLNR:

The intent of the mosquito release program is doubtless laudable, and the strategy is indeed clever. But one thing we should have learned by now about the release of exotic flora and fauna in the wild in Hawai'i is that THE LAW OF UNANTICIPATED CONSEQUENCES has yet to be repealed. The mongoose, the lantana, the axis deer, and the kiawi should have taught us that.

> I am opposed to the planned biopesticide mosquito releases on Maui, and want an Environmental Impact Statement. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.
>
> Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.
>
> The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.
>
> The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS). I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

Please consider the risks, and the delicate nature of the Hawaiian ecosystem. Before such a reckless plan is implemented, we should have a detailed, comprehensive EIS to analyze possible consequences downstream.

Sincerely,

Tama Starr
Kaupo

From: Mele Stokesberry
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Approval of the Incompatible Insect Technique to save forest birds
Date: Wednesday, March 8, 2023 1:31:58 PM

To the Department of Land and Natural Resources- Division of Forestry and Wildlife
Testimony in favor of the Wolbachia Incompatible Insect Technique

Approval for the well-vetted program of Incompatible Insect Technique is urgent, as there are only 17 species remaining of Hawaii's precious and unique forest birds. The once-50 species of these honeycreepers evolved over millennia and could be wiped out in a few years if we can't stop the spread of the avian malaria which, due to climate change, is brought higher and higher into our mountain forest by the mosquitos that used to be suppressed by the colder temperatures at higher elevations. One bite by an infected mosquito can kill an ʻiʻiwi.

Thank you for considering my testimony. I am a board member of the Friends of Haleakalā National Park, but I am writing as an individual.

Mele Stokesberry
51 Mano Dr., Kula, HI 96790

From: Kaleiheana-A-Pohaku Stormcrow
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda item C-2
Date: Monday, March 6, 2023 9:27:38 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT, Agenda Item C-2 on the proposed use of the *Wolbachia* Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

I believe our extinction crisis is a dire situation which needs to be addressed immediately. There was once more than 50 species of our unique endemic honeycreepers, but today only 17 remain; some with fewer than 500 individuals. If we do not take immediate action, several species are projected to become extinct in ten years, which is likely an overestimation of the time that remains for them. As avian malaria is the driving force in their extinction, with mortality rates at 100% from a single bite for species like the iconic ʻIʻiwi, it is essential that we release incompatible *Wolbachia* mosquitoes to help save our forest birds. Mosquitoes have already started to move up-slope, and this will continue as the climate warms, bringing mosquitoes to the last remaining refugia for Hawaiʻi's forest birds. The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds

I believe the proposed conservation actions have been sufficiently researched, and are safe and effective for controlling mosquito populations, and pose no risk to humans or anything else. This may be our last chance to save our native forest birds from the very real threat of avian malaria.

Please **SUPPORT** the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui!
Kaleiheana-a-Pōhaku Stormcrow

--
Kaleiheana-a-Pōhaku Stormcrow
Graduate Assistant/Avian Wildlife Tech, Price Lab
Department of Natural Resources and Environmental Management
University of Hawaiʻi Mānoa
pronouns: they/them

From: Wendy S
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] My mana"o in support of Birds Not Mosquitoes (Incompatible Insect Technique)
Date: Wednesday, March 8, 2023 11:11:07 AM

Kauai and Maui Forest Bird Recovery Projects asked for testimony regarding their project, and I had already written this very personal statement to explain to a friend why I support it, so here it is!...

In the year 2000, I had returned to the US after teaching English in Japan for 3 years. I wasn't sure what I wanted to do next. I decided that I didn't care whether everyone in the world spoke English--but I DID care whether everyone in the world treated the world itself with care.

I took an administrative job at the University of California at Berkeley, and audited a class on American Wildlife, as well as taking advantage of access to the academic libraries, especially the science library.

I had thought that I wanted to go to grad school in Environmental Science, but decided against it--I didn't want to write a thesis on some particular bird's nesting success that only other academics would read. Dr. Steven Beissinger, who taught my American Wildlife class, confirmed what I had already learned: We KNOW why so many species are becoming endangered, and I realized that what I wanted was to get that message out to the general public.

These are the 5 drivers of extinction: Habitat Loss (forest clearing, wetlands draining, coral reef destroying...), Pollution (pesticides, microplastics, oil refineries, industrial chemicals, pharmaceuticals...), Over-exploitation (depleting fisheries, hunting big game...), Climate Change, and Invasive Species.

I moved to Hawaii, the US capital of endangered species/extinction in 2000, and volunteered at Haleakala National Park, and the knowledge I had gained from my reading and classes got acknowledged--the Hawaii Natural History Association hired me as a Park Interpreter, to lead hikes, give talks, and work behind the counter at the visitor centers.

I left Hawaii in 2003 because my husband took a job teaching English in Germany. I didn't want to go back to teaching English myself, so I volunteered for a nature organization there, and when we moved back to the States, got an Interpreter position at another national park site, Alcatraz Island. There were nesting colonies of seabirds on Alcatraz, but I was mostly interpreting history, of course, so when I decided to leave my marriage and the city, I applied to other national parks where I could interpret *natural* history and became a National Park Service ranger for a season at Crater Lake National Park in Oregon.

When I returned to Maui in 2008, I worked for Maui Invasive Species Committee, visiting classrooms to educate students about invasive species and processing data from field crews on the office computer system.

I learned that out of 100 species introduced by humans, only about 10 would spread outside the garden or pen where it was introduced (accidentally or on purpose) and only 1 would become invasive--spreading and causing harm to native or agricultural species.

I learned that no one aspires for their children to become environmental scientists the way they want doctors or lawyers--there's little money in it! The biologists I know are in it because they care. The birds aren't paying them off.

I met Chuck Chimera, who analyzed newly introduced species or planned introductions against a global database of species found to be invasive in other parts of the world, and against known characteristics of invasive species.

I attended the releasing of a tiny ant-sized wasp in December 2008, carefully chosen from potential predators of the Erythrina Gall Wasp, an accidentally introduced invasive species, killing Maui's wiliwili trees, a keystone species of our dryland forests. The parasitic wasp was chosen after extensive testing to ensure it would feed on nothing else but the invasive wasp. And it worked. We saved wiliwili trees! Schoolchildren had been collecting seeds in case we lost all the trees in the wild.

Now environmental organizations are trying to save Hawaii's native forest birds. Out of 54 Hawaiian honeycreeper species evolved from Asian rose finches, only 17 remain. The main threats are diseases carried by invasive mosquitoes, habitat loss, and climate change. You can still see the 'I'iwi, or Scarlet Honeycreeper, with its bright vermillion feathers and long downcurved beak flitting among the flowers and singing a flutey, creaky song in Haleakala National Park, but only at high elevation, where it is too cool for the Southern House Mosquito carrying avian malaria--and with climate change, that elevation range is getting higher and smaller. Kaua'i and Oahu have already lost most of their 'I'iwi, since their mountains don't rise high enough.

We will probably lose 2 more honeycreeper species from Maui in the next 5 years, if we do not do something about the mosquitoes. I care about the Kiwikiu, the Maui Parrotbill, because it is a beautiful, unique bird associated with koa trees, and has a gorgeous song soon to be lost to the world. But I wish that everyone cared about these "canaries in the coal mine." Surely we can't go on destroying habitat, polluting, letting invasive species run rampant, without harming our own health along with the planet. The Maui Parrotbill has been in a captive breeding program, but even though the Maui Forest Bird Recovery Project planted a new koa forest in a dryland area, hoping there would be fewer mosquitoes, out of a dozen birds released into the wild, nine died from avian malaria.

The Birds Not Mosquitoes project is our best hope for reducing the mosquito population and saving our forest birds from extinction. Our biologists did their homework--it's not GMO, and they are not even introducing a new species of mosquito or bacteria. The process is to take male mosquitoes from eggs laid here, remove the strain of Wolbachia bacteria they were born with, infect them with a different strain--not found in mosquitoes here, but already naturally occurring in other arthropods on Maui--and release them into the wild on Maui, so that when one of these male mosquitoes (males don't bite or feed on blood) mates with a wild female, the incompatible bacteria keep her eggs from being fertilized, acting as mosquito birth control! The Wolbachia bacteria is only passed on through heredity--from the female mosquito to her larvae, in the wild. It cannot jump between arthropod species, as shown by the fact that other arthropods already have the Wolbachia bacteria being introduced to the male mosquitoes, but no other wild mosquitoes have that strain. This technique has already been used in other parts of the world successfully--not eradicating but reducing mosquito populations and incidence of disease, without affecting any other arthropods.

I recently read an article in the Amercan Bird Conservation (ABC) magazine about Dr. Sheila Conant, a University of Hawaii professor, who was asked how it felt, having seen birds in the wild that are now extinct. She said it was heartbreaking, that our efforts have been "too little, too late." I have seen one Maui Parrotbill in the wild and three Crested Honeycreepers ('Akohekohe), which cannot survive in captivity. May I never learn how she feels.

My best friend Judy was dating a biologist who was involved with trying to save the Po'ouli from extinction. There were only 3 birds left, and they failed. She knows of the heartbreak.

I have been reading the book Figuring by Maria Popova (2019), an interwoven biography of several heroic real-life figures. Last night I was reading about a great heroine of mine, Rachel Carson, who stood up for the lives of birds against the industrial manufacturers of DDT. She is the reason for the recovery of the Bald Eagle, the Osprey, the Pergrine Falcon, among others that were on the road to extinction. On page 502 of this 545-page book, the author corrects the misconception that Carson, who worked for the US Fish and Wildlife Service, was against mosquito control of any kind:

"Reading from eleven neatly typed double-sided notecards, she proceeded to offer 'imaginative, creative, and scientifically sound' alternatives to the blunt weapon of chemical pesticides. Among the most imaginative of them was a prescient vision for biological controls that would curtail the reproduction of a particular species without harming other organisms. Exactly fifty-five years later, the Environmental Protection Agency--the founding of which was a direct consequence of Carson's work--would announce the approval of a pioneering technique for controlling the population of disease-carrying mosquitoes by releasing lab-raised males infected with a bacterium that renders the female sterile. Carson concluded her presentation with a vital challenge to the government: 'These approaches... require support--the support of increased funds, the support of public understanding. In this direction, I am convinced, lies the best hope for our future.'"

Wendy Swee
808-268-9414
Pukalani, Maui, Hawaii

From: Kestrel Swift
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony regarding C-2
Date: Wednesday, March 8, 2023 10:26:53 PM

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Kestrel Swift

From: Graham Talaber
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Wolbachia testimony
Date: Thursday, March 9, 2023 9:03:46 AM

Hello,

I’m too busy in the field/photographing/filming the 'akikiki before it goes extinct to write a long testimony.

Please help save Hawai'ian forest birds by supporting the use of Wolbachia to reduce the density of mosquitoes!

Mahalo,
Graham Talaber

From: Lynn Taube
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai
Date: Tuesday, March 7, 2023 8:47:09 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of plan and the ***impacts to our native birds, wildlife, environment, and public health****.*

I Demand an Environmental Impact Statement(EIS).

Thank you,

Lynn

Holualoa Companies
Lynn Taube
Executive Vice President
(808) 329-6060 Ext.1
Lynn@HolualoaKona.com
Holualoa Management Corporation
Principal Broker (RB)
75-5706 Hanama Pl 104 Kailua Kona HI 96740

From:	sharkgss
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] BLNR Meeting 3/10/23 9:15am Agenda Item C2 "Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DBLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai"
Date:	Monday, March 6, 2023 3:45:47 PM

Aloha,

I'm **strongly opposed** to the planned biopesticide mosquito releases on Maui and all Hawaiian Islands. **Once this plan starts, it is irreversible**. This project is an experiment that could have significant secondary impacts. The outcome is admittedly unknown according to Department of Interior documents.

I do not accept the Environmental Assessment's (EA) Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health. The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human).

There are no quality control measures proposed in the EA that outline how batches of lab mosquitoes will be tested for pathogens.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed).

This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

Who will take responsibility if something goes wrong – the federal government, the State of Hawaii, steering committee partners, private landowners? Adequate studies and research have not been conducted. Conflicts of interest have not been disclosed or addressed, and the state is rushing forward with this project without the consent of the people of these islands.

Public testimony has shown overwhelming opposition to these mosquito releases. The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health.

I demand and Environmental Impact Statement (EIS) for the proposed "Suppression of Non-native Wild Mosquito Populations to Reduce Transmission of Avian Malaria to Threatened and Endangered Forest Birds on East Maui."

Mahalo,

Donna Thompson

Kamuela, HI

Sent with Proton Mail secure email.

From: Matthew (Matt) Toenies
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Submitting testimony in strong support of agenda item C-2
Date: Wednesday, March 8, 2023 3:30:28 PM

Hello,

I am submitting testimony in strong support of agenda item C-2.

Honeycreepers are a unique group of forest birds found only in Hawai‘i, which once had more than 50 species. Today, only 17 species remain, some with fewer than 500 individuals left. Without immediate action, several species of Honeycreepers will become extinct in the next ten years, and at least one is projected to go extinct potentially this year or next..Avian malaria, a disease transmitted by invasive southern house mosquitoes, is driving the extinction of our forest birds. A single bite by an infected mosquito can kill an ‘i‘iwi. As the climate warms, mosquitoes carrying avian malaria are moving upslope into the last refugia for Hawai‘i’s forest birds. The Incompatible Insect Technique can suppress mosquito populations and help save our native forest birds.

Our native Honeycreepers are foundational to the culture, forests, and ecosystems of Hawai’i. On the island of Kaua’i, we have already lost dozens of forest bird species due to avian diseases transmitted by non-native mosquitoes, among them iconic species like the Kaua’i ‘ō’ō, featured in mahiole and ‘ahu ‘ula, and the spectacular Kaua’i ‘akialoa, a pollinator of ‘ōhi’a lehua and insect eater. We are grieving the loss of their song, the loss of their beauty and the loss of their presence.
Of the six remaining Honeycreepers species on Kaua’i today, two are critically endangered. The ’akikiki is going extinct in the wild as you are reading these lines and the ‘akeke’e is predicted to go extinct in the wild within the next couple years. As pollinators, seed dispersers, and insect eaters, they are essential for our forests and without action or delayed action, these species have no chance of survival.
The incompatible insect technique or mosquito birth control provides us with a glimmer of hope and opportunity to save the last remaining Honeycreepers from extinction. This method has been used successfully worldwide for vector control for human diseases and gives us a powerful tool to address the main cause for the decline of our Honeycreepers: avian malaria transmitted by the Southern House Mosquito. Neither the disease nor the vector is native to the Hawaiian islands and the mosquitoes have invaded the highest elevation of our island, decimating our Honeycreeper populations every day. Our forest birds evolved in a mosquito-free Hawai’i and a single bite of an infected mosquito can be enough to kill an ‘i’iwi.
The question to consider for our forests and for our ecosystem: How many more native forest bird species can we afford to lose, before the environmental impact will lead to the collapse of our native Hawaiian forests and watersheds?

Sincerely,
Matt Toenies
(he/him)

From: Ma"ata Tukuafu
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSED to the mosquito release plan
Date: Monday, March 6, 2023 1:50:44 PM

I, Ma'ata Tukuafu of Kamuela, HI 96743 oppose the mosquito release plan. Mahalo, Ma'ata

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

--

Ma'ata Tukuafu
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai‘i 96850

In Reply Refer to:
01EPIF00-2023-Inv

Ms. Dawn Chang
Chairperson
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Subject: U.S. Fish and Wildlife Service Support of Collaborative Efforts to Prevent Forest Bird Extinction in Hawai‘i

Dear Chairperson Chang and Board:

The iconic and endangered Hawaiian forest birds are an important cultural and biological resource, yet are facing an extinction crisis. Currently, most Hawaiian forest birds are found only at high elevations, where climate restricts the range of mosquitoes and transmission of the avian malaria - but the changing climate is allowing mosquitoes to move into these high elevation refugia. With already small population sizes and little to no resistance to malaria, extinction of these endemic birds is imminent: three forest bird species are in danger of extinction in as little as two years, and nine additional forest bird species are at risk of extinction in the near future.

The mission of the Service is to work with others to conserve, protect, and enhance fish, wildlife, plants and their habitats for the continuing benefit of the American people. In association with our mission, the Service is charged with the implementation of the Endangered Species Act (ESA) and works with partners to support the conservation and recovery of listed species in the wild. In the Hawaiian Islands, threats to listed species are often compounded by the synergistic effects between climate change and invasive species – challenges that require new and expanded tools if we are to preserve biodiversity in Hawai‘i. Preventing the extinction of Hawaiian forest birds will require a comprehensive strategy that includes landscape-level mosquito control, translocation of birds to other islands, establishment of captive populations, and developing next generation tools that increase the scope or efficacy of these actions.

Existing conservation efforts will not be enough to prevent the extinction of Hawaiian forest birds – new tools that can control invasive mosquito populations in remote and sensitive habitats are critical to the survival of these species. Both the Service and the Hawai‘i Department of

Land and Natural Resources (DLNR) are part of a coalition of partners in the Birds Not Mosquitoes Working Group, and together have supported the development of a *Wolbachia* based biopesticide[1] in *Culex* to suppress mosquito populations in Hawai‘i. Specifically, the Service and the DLNR are co-leads on the implementation of this biopesticide on priority conservation areas on the island of Kaua‘i to address mosquito populations that are impacting endangered and threatened forest birds.

The Service has reviewed and evaluated the information pertaining to this *Wolbachia* based biopesticide. Based on the information available to us we find this biopesticide is consistent with other incompatible insect technology (IIT) tools used to control mosquitoes for public health, which have been shown to be highly effective. We further anticipate the likelihood for non-target and environmental effects from the use of this technology in Hawai‘i are negligible. Therefore, we remain supportive of efforts to advance this IIT tool for conservation.

Efforts are currently underway by several state and federal resource management agencies and non-governmental partners related to public engagement, environmental compliance, and infrastructure that facilitate the use of IIT tools for conservation use in Hawai‘i. We appreciate your consideration and support of these collective efforts and look forward to continuing to work closely with the Hawai‘i Department of Agriculture, the Hawai‘i Department of Land and Natural Resources, the National Park Service, and other non-governmental organizations to carry out these conservation actions to protect Hawaiian forest birds from extinction.

If you have any questions regarding this letter or how IIT and other forest bird conservation projects align with the Service’s conservation strategy, please contact me at Michelle_Bogardus@fws.gov or by telephone at 808-792-9400.

Sincerely,

Michelle Bogardus
Pacific Islands Fish and Wildlife Office
Assistant Field Supervisor

[1] Biopesticide: certain type of pesticide derived from natural materials such as animals, plants, bacteria, and minerals. (U.S. Environmental Protection Agency)

From: Niki van den Hurk
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] GMO Mosquitos
Date: Tuesday, March 7, 2023 6:25:15 PM

To Whom It May Concern,

Please DO NOT release GMO mosquitos into our Aina. You have NO testing and you have no idea how it will affect us, or our wild life long term. This is reckless and insane!! We need proper testing to be done.

Thank you,
Niki van den Hurk

From: Jacqueline
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Do not release genetically modified mosquitos
Date: Monday, March 6, 2023 5:57:52 PM

Absolutely a bad idea. Messing with nature. I am writing to oppose this bill and terminate the idea.

Don't destroy the Hawaiian islands.

Jacqueline Van Rossen
473 Puuopae Rd.
Kapaa, HI 96746

From: Peter Vanosdall
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Tuesday, March 7, 2023 9:30:46 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

> the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
> the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,

Peter Vanosdall

From: ash
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Written Testimony in Support of Agenda Item C-2
Date: Thursday, March 9, 2023 6:31:15 AM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I, Ash Vesido, am in support of **Agenda Item C-2** on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui. Currently, there are only 17 out of 50 honeycreeper species that remain on our island; they are among some of the 17 forest native birds poised to disappear. These numbers have only decreased in recent years to vector-borne disease, *avian malaria,* and other mosquito-borne illnesses. The native forest birds, especially the honeycreeper, are crucial to our ecosystem and culture. Throughout my whole life, I've lived in these islands, grown to adore the Hawaiian culture, and experienced the bountiful traditions and lifestyle of the Hawaiian islands. To see the native birds that used to roam our islands, slowly extinct due to the causes of climate change and diseases is heartbreaking. For this reason, I hope you will consider this testimony for the implementation of the use of mosquito birth control to bring our native forest birds back from extinction and towards abundance. Mahalo for your consideration.

Sincerely,
Ash Vesido

From: Kelly Sinclair Vicars
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony in support of Agenda Item C-2
Date: Wednesday, March 8, 2023 9:25:47 AM

Dear Chair Designate Chang & members of the Board of Land and Natural Resources,

I am submitting testimony **in support of Agenda Item C-2** on the proposed use of the Wolbachia Incompatible Insect Technique to prevent the extinction of the endangered Hawaiian honeycreepers living on Kauaʻi and Maui.

As a Kauai resident, I have been eagerly learning about our forest birds and the proposal to save them. I am compelled by this courageous effort because the forest birds are of huge ecological, cultural, and spiritual importance to this island.

I believe the proposed conservation actions are both safe and necessary, and represent a creative solution to aiding the honeycreepers that will certainly go extinct without our help.

Please SUPPORT the mosquito control efforts touched upon in agenda item C-2.

Mahalo nui,
Kelly (Kalaheo, Kauai)

--

kelly sinclair vicars
www.kellysinclairvicars.com
719.351.8622

From: Tania Victorine
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date: Tuesday, March 7, 2023 10:22:31 AM

I'm opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

From:	Volcanic Rock Gym Information
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date:	Tuesday, March 7, 2023 9:52:01 PM

Dear Chair Designate Chang and members of the Board of Land and Natural Resources,

I SUPPORT Agenda Item C-2 which proposes two actions:

the use of the *Wolbachia* Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui

the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

Native Hawaiian honeycreepers are extremely important to Native Hawaiian culture and the ecology of Hawai‘i. Decades of research have shown that diseases spread by invasive mosquitoes are currently the greatest immediate threat to the existence of Hawaiian honeycreepers. If action is not taken to suppress mosquitoes and avian malaria in forest bird habitat as soon as possible, we will lose these birds to extinction forever. That loss would be akin to the death of a beloved family member and would rob future generations the privilege of building a relationship with these amazing birds. Honeycreeper extinctions would also impact our native forests greatly, since honeycreepers are important pollinators of native species such as ‘ōhi‘a. Hawai‘i residents rely on healthy native forests to help gather rain and collect the freshwater that we need to live in Hawai‘i.

The proposed conservation actions are our best hope for preventing the extinctions of our honeycreepers on Maui and Kaua‘i. Wolbachia IIT has been used successfully in other parts of the world to suppress mosquitoes and the diseases they spread. Since applying this technique will take time, conservation breeding centers in Hawai‘i can be used as temporary holds for ‘akikiki and kiwikiu, the honeycreeper species at highest risk of extinction due to avian malaria in the next few years.

Someday, our children and grandchildren will look back at this point in our history. I hope that they will be able to say that we stepped up to the challenge and saved Hawai‘i’s honeycreepers through swift, scientifically informed action.

I urge you to please SUPPORT the mosquito control efforts outlined agenda item C-2.

Mahalo nui for the opportunity to provide testimony,
Volcanic Rock Gym

From: Lorraine "Mamo" Waianuhea
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Support Agenda Item C-2 to save Hawaiian honeycreepers
Date: Thursday, March 9, 2023 12:33:51 AM

Aloha e Chair Designate Chang and members of the Board of Land and Natural Resources,

I am writing in **SUPPORT** of Agenda Item C-2 which proposes two actions:

1. the use of the Wolbachia Incompatible Insect Technique (IIT) to prevent the extinction of the endangered Hawaiian honeycreepers living on Kaua‘i and Maui
2. the establishment of viable populations of two extremely imperiled honeycreeper species - the ‘akikiki and kiwikiu - at conservation breeding centers in Hawai‘i until the threat of mosquitoes and avian malaria has been lowered and the birds can be safely released into the wild

As a native Hawaiian person, Hawai‘i resident, and graduate student studying *Culex quinquefasciatus* mosquitoes at UH Mānoa, I believe these actions are our best hope for suppressing avian malaria and preventing the extinctions of honeycreepers on Kaua‘i and Maui. From my experience reading the literature and thinking about this issue over the past few years, the agenda item C-2 document is thorough and demonstrates the decades of research on honeycreepers, avian malaria, and mosquitoes that have been conducted in Hawai‘i. I also identify with the perspectives offered by native Hawaiian participants in Technical Report HCSU-103 regarding the cultural significance of and deep respect for forest birds as beings with ancestral and spiritual/godly power. Extinction would be devastating for moral, cultural, and ecological reasons.

It is clear we are living in a critical time for the survival of Hawaiian honeycreepers. We know that continuing down the same well-worn path of making no effort to control avian malaria will lead to many extinctions. However, for the first time, we have a tool available (Wolbachia IIT) that gives us a chance at paving a new trail to honeycreeper recovery in Hawai‘i.

As the stewards of today and the ancestors of tomorrow, it is our kuleana (responsibility and privilege) to do everything we can to conserve honeycreepers for future generations. Unfortunately, Kaua‘i and Maui honeycreepers are running out of time. Avian malaria suppression in forest bird habitat is needed as soon as possible.

I urge you to please SUPPORT the proposed actions outlined agenda item C-2.

Mahalo for the opportunity to provide testimony,
Lorraine Waianuhea

From:	Andrea Walker
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] OPPOSE Agenda Item C2: DLNR"s proposed Strategy to prevent Bird Extinction on Maui & Kauai
Date:	Tuesday, March 7, 2023 8:59:58 AM

I DO NOT accept the environmental assessment's anticipated findings of no significant impact (DEA-AFONS). The scope, risk and experimental nature of the this plan requires detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment and public health.

I demand an environmental impact statement (EIS) to be completed.

I love this state and the beauty it has, don't ruin it please. We don't need any more mosquitoes.

Thank you in advance for your time and consideration.

Mahalo,

--
Andrea Walker
Direct: 808-375-4346

From:	Sheila Walker
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Subject: OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Wednesday, March 8, 2023 5:36:13 AM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health.***

I Demand an Environmental Impact Statement (EIS).

Sheila Walker
PO Box 164
Kihei, HI 96753

From: Bryn Webber
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda item C2
Date: Tuesday, March 7, 2023 8:32:17 AM

I am submitting testimony in strong support of agenda item C-2. Our native Honeycreepers are foundational to the culture, forests, and ecosystems of Hawai'i. On the island of Kaua'i, we have already lost dozens of forest bird species due to avian diseases transmitted by non-native mosquitoes, among them iconic species like the Kaua'i ʻō'ō, featured in mahiole and ʻahu ʻula, and the spectacular Kaua'i ʻakialoa, a pollinator of ʻōhi'a lehua and insect eater. We are grieving the loss of their song, the loss of their beauty and the loss of their presence. Of the six remaining Honeycreepers species on Kaua'i today, two are critically endangered. The 'akikiki is going extinct in the wild (20-100 estimated left, down from 350+ in 2019) as you are reading these lines and the ʻakeke'e is predicted to go extinct in the wild within the next couple of years (<1000 individuals). The iconic red i'iwi has disappeared from several areas of the Alakai wilderness where they were previously abundant only 3 years ago. As pollinators, seed dispersers, and insect eaters, they are essential for our forests and without action or delayed action, these species have NO chance of survival. The incompatible insect technique or mosquito birth control provides us with hope and the opportunity to save the last remaining Honeycreepers from extinction. This method has been used successfully worldwide for vector control for human diseases and gives us a powerful tool to address the main cause for the decline of our Honeycreepers: avian malaria transmitted by the Southern House Mosquito.

Claims by groups like Hawaii Unite are uninformed and detrimental to the greater community of citizens who want to preserve native ecosystems. There has been a great amount of money that has already been spent on years of research and collaboration between agencies and organizations to come up with a safe and realistic solution for mosquito control in the Hawaiian islands. Their claims that these mosquitoes could impact human health are completed unfounded. On the contrary, wolbachia has been used to combat human diseases such as dengue, Zika, and chikungunya in other countries around the world. Culex mosquitoes can also carry several diseases that can infect humans, including West Nile Virus and Japanese encephalitis.

Given that there will be no impact to humans, saving our birds should be at the forefront of this discussion. Neither the disease nor the vector is native to the Hawaiian islands and the mosquitoes have invaded the highest elevation of our island, decimating our Honeycreeper populations every day. Our forest birds evolved in a mosquito-free Hawai'i and a single bite of an infected mosquito can be enough to kill an ʻi'iwi. The question to consider for our forests and for our ecosystem: How many more native forest bird species can we afford to lose, before the environmental impact will lead to the collapse of our native Hawaiian forests and watersheds?

From: Joanna Weber
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2
Date: Tuesday, March 7, 2023 6:08:39 PM

ALOHA

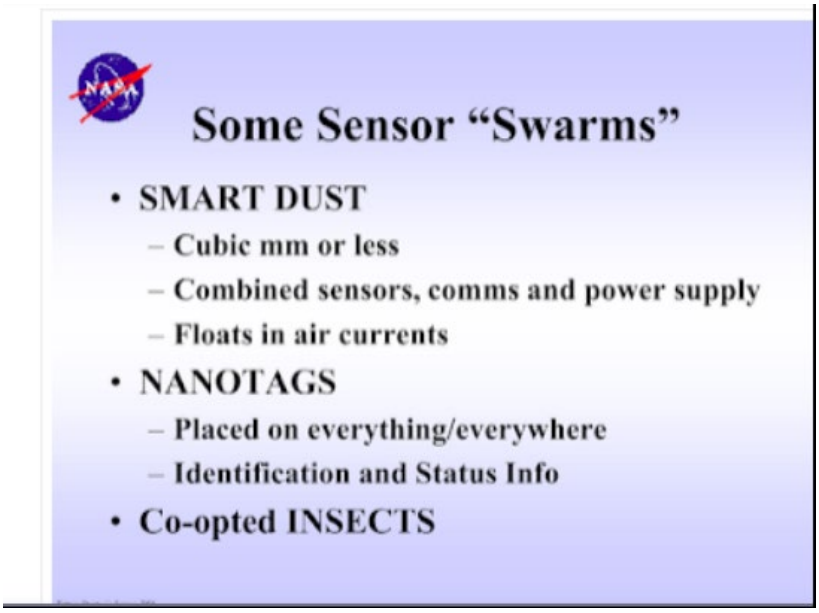
I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI).

The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health.***

I Demand an Environmental Impact Statement (EIS).

ALOHA, JOANNA WEBER
Kailua-Kona, Hawaii 96740

From: Sherilyn Wells
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Agenda Item C2 - proposed release of Wolbachia mosquitoes (biopesticide mosquito experiment). Co-Opted Insects as per NASA"s presentation???
Date: Tuesday, March 7, 2023 11:37:59 PM
Attachments: image.png
image.png
co-opted insets as swarms in future warfare from NASA.png

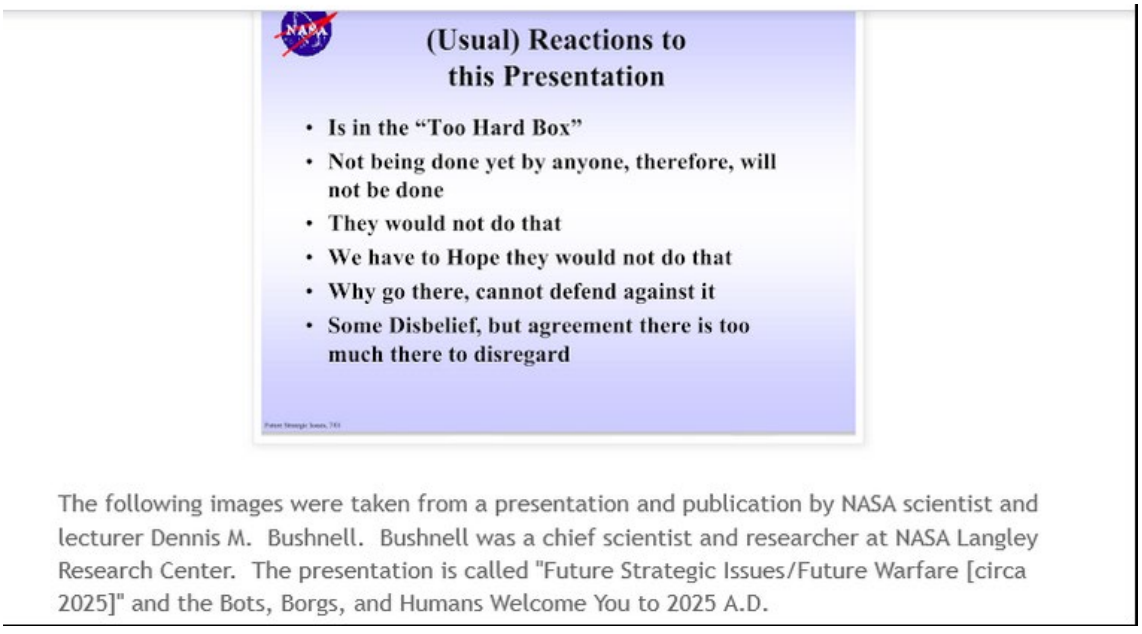


The image above is from a **NASA slideshow on warfare**. **Notice "Co-opted Insects."** The **NASA slide that preceded this slide can be seen further down in this email**.
It describes the reactions people are likely to have to the above information..AND the title of the presentation is "welcoming" us to 2025. Not too far off.. interesting coincidence/confluence?

As to the proposed Mosquito Release/Experiment: I strongly **OPPOSE** this action.
An Environmental Impact Statement is a necessity for such a dramatic meddling with the balance of our island ecosystem(s), with so much potential for unintended (because it's insufficiently studied!!) negative consequences to avian, human, animal, insect, and ??? populations. As the NASA slide shows, innovative deployment of insects as a tool of war is already under investigation and since Bill Gates and his Foundation have a link to both the Covid-19 situation and to the Wolbachia studies, we have additional reasons to suspect that all is not as it is might seem (is made to seem?).
I have a background that lends support to my position on this issue:
I am a former co-president of the Washington (State) Environmental Council, a statewide organization coordinating/representing dozens of local groups, including on issues and testimony before our state government. I have contributed language that was added to legislation in Washington State when we were adopting, then amending, the Growth Management Act, a comprehensive plan for our future that looked at ALL elements of development, resource preservation, environmental health, etc.
As part of that GMA process, I had the opportunity to read and contribute data and suggestions to many EISs. I could tell the difference between an EIS that was a genuine investigation into impacts and an EIS that was prepared for a foregone conclusion promoted by vested interests colluding with corrupted agencies/institutions. But, bad as some of those EISs were (and they were forced to improve before being accepted), at least there **WAS** an

EIS.
Why is this even an issue of debate, when it's so clearly needed?
We need to stand meaningfully behind all the times we Hawai'ians speak reverently of "the aina," to breathe life into those words with actions that actually DO protect this land, DO honor the sacred responsibility of caring for it with the best of our minds/knowledge and the best of our hearts/integrity.
I am also a former Board Member of the Washington Toxics Coalition, which spearheaded successful efforts to raise public (and legislative) awareness about the insidious effects of substances, many in common use. It was surprising how many times products snuck onto the market, only to have multiple toxic/negative effects due to so many unforeseen interactions/mechanisms. For instance, controlled-environment-lab results didn't translate into uncontrollable-real-world-environments with their vastly more complex set of influences; additive, cumulative, and/or synergistic effects when encountering other chemicals were not considered; safe exposure data was often much too liberal, as effects were subsequently observed at much lower thresholds than were originally devised, etc., etc. All of these points could just as easily be applied to this Mosquito Plan/Experiment.

So, between these two organizations I gained extensive experience in evaluating whether a proposal merited additional study before any further decisions were made. Rarely have I seen a proposal for which a full-scale EIS was not only appropriate, but a CRITICAL next step, as this Mosquito Release proposal before you.
Now to return to the point made by the first image in this email - Let me suggest one avenue you have obviously not considered in the far too cavalier conclusion that this doesn't merit an EIS. **The use of "co-opted" insects as part of a new human warfare strategy** - this concept was part of a Future Strategic Issues, Future Warfare presentation by NASA scientist Dennis M. Bushnell, at the NASA Langley facility (Langley being CIA, of course).



We have all witnessed, in these last few years, what happens when there is suppression/censorship of alternative professional viewpoints, when no critical debate is allowed (analogous to in-depth study of an issue from all sides). Thanks to dogged efforts by people and professionals who simply would not be silenced, who stood up for humanity at

great cost to themselves.. and who are now being proved right, over and over again as the truth emerges, we have an analogous lesson to THIS issue. We need to see this issue from every possible angle before we proceed or before we call a halt. If we have learned only one lesson from the Covid-19 situation, it is that vigorous analysis and questioning and study benefit everyone and might just avert another (mosquito-based) monumental act of stupidity, of destruction, as SOME humans imagine we are clever enough to anticipate how a complex ecosystem will adapt to elements that ultimately will themselves evolve.
We are increasingly made aware that the gain-of-function, lab origins of Covid-19 give it the status of a bioweapon. As the attached image taken from a slideshow given by NASA scientist Dennis M. Bushnell reveals - insects are part of the new warfare strategy. Who's to say that this Mosquito Plan is not being deployed in similar fashion, given the evidence that people completely without conscience will set about decimating populations while smiling into the camera and assuring all of us that nothing is amiss. A failure to do an appropriate analysis makes such an uncomfortable viewpoint more, rather than less, likely.

Mahalo for what I hope is your decision to reconsider your apparent fast-tracking of this proposal and to insist upon excellence in the analysis contained within the EIS you mandate.
Sherilyn Wells
68-1921 Lina Poepoe St
Waikoloa, Hawaii 96738

Adding my previous comments to this current testimony:

> On Friday, July 15th, 2022 at 1:59 PM, Sherilyn Wells <votetrees@protonmail.com> wrote:
>
> > **To: Suzanne D. Case, Chairperson Board of Land and Natural Resources**
> > **From: Sherilyn Wells, resident, Big Island of Hawaii, 360-441-7098, votetrees@protonmail.com**
> >
> > **The Hawaii Department of Agriculture is fast-tracking a release of Wolbachia-laden mosquitoes with virtually no significant environmental review. This is a shocking failure of responsibility to safeguard our island environment, including plants, animals, humans, soil microorganisms, etc.**
> >
> > **I urge the BLNR to require a full EIS, including the topics mentioned below.**
> >
> > **(1) First of all, what/who is the source for these mosquitoes? See information below on Gates Foundation, Oxitec, and Wellcome.**
> >
> > **(2) There are medical research articles, some dating back decades, pointing to the potential for the Wolbachia bacterium to affect human health.**

Didier Raoult, in Goldman's Cecil Medicine (Twenty Fourth Edition), 2012

***Wolbachia* Species**

***Wolbachia* bacteria are endosymbionts of arthropods and nematodes. They were known to be present in filarial worms, but it was later shown that they may play a role in human disease.**

These bacteria manipulate the fertility of their host.

https://embryo.asu.edu/pages/wolbachia

***Wolbachia* evolved ways to jump across host species and establish relatively stable associations maintained through vertical transmission. *Wolbachia* are capable of manipulating the reproduction of infected hosts in a remarkable way.**
https://www.frontiersin.org/articles/10.3389/fevo.2015.00153/full

(3a) As stated above, this bacterium is particularly implicated re the reproductive capacity of its hosts, including (although not limited to) the testes and ovaries, which it often targets in the species it infects.

Curiously, these are also among the particular tissues which SARS-CoV-2's spike protein is partial to inhabiting/infecting, according to Japanese research which confirmed the spike protein was not confined to the injection site.

(3b) Is there any possibility of cross-function amplification or symbiotic interaction of Wolbachia and spike proteins (or SARS-CoV-2), found in the same tissues?

(4) We must also consider the possibility that GAIN OF FUNCTION research could have been carried out, adding to the list of potential impacts from the modified mosquitoes and Wolbachia.
Have either of these organisms (mosquito OR Wolbachia bacterium) undergone any gain-of-function alteration that could render them more pathogenic? An in-depth review of potentially relevant research articles is warranted, to the degree

that content of such "secretive" research can be ascertained.

Since the Gates Foundation has been involved in funding mosquito, Wolbachia, and vaccine experimentation, it is worth taking the time for Hawai'i to study whether there has been any cross-application of findings.

Specifically, Gates has already linked the use of Wolbachia to coincide with provision of vaccines. Could there be undisclosed connections/symbiotic performance anticipated between the two actions?

Here it suggests that the bacterium be used in infected mosquitoes as an adjunct to Yellow Fever vaccines:

> ***"Although the YFV vaccine is safe and effective, it does not always reach populations at greatest risk of infection and there is an acknowledged global shortage of vaccine supply.***
> ***The introgression of Wolbachia bacteria into Ae. aegypti mosquito populations is being trialed in several countries (www.worldmosquito.org) as a biocontrol method against dengue, Zika and chikungunya.***
>
> ***Here, we studied the ability of Wolbachia to reduce the transmission potential of Ae. aegypti mosquitoes for Yellow fever virus (YFV).***
> **https://gatesopenresearch.org/articles/3-161**

"Genetically modified mosquitoes are showing promise in controlling other vector-borne diseases, so we look forward to exploring their use alongside complementary interventions for malaria."

(5) Obviously, there has already been some alteration of mosquitoes and Wolbachia already, as Bill Gates reveals:

> ***Unfortunately, the type of mosquito that carries dengue, Aedes aegypti, doesn't naturally get Wolbachia, but one group of scientists discovered a way to infect them with it. Now, in partnership with other researchers around the***

> ***world, they're raising a colony of Wolbachia mosquitoes to be released in hopes that they will breed with wild mosquitoes.***
> ***https://www.gatesnotes.com/Health/Why-I-Gave-Blood-to-Defeat-Dengue-Mosquito-Week***

The Gates Foundation has donated to (1) Oxitec, which does mosquito research, and to (2) research involving the Wolbachia bacterium. And, through GAVI and other organizations, it has played a major role in the vaccination of certain populations (some of whom sued the Foundation after extensive disability, damage, and death occurred).

Proof of Gates Foundation involvement with Wolbachia, alteration of mosquitoes, etc.:
https://www.gatesfoundation.org/about/committed-grants/2020/09/INV019029
https://www.worldmosquitoprogram.org/en/about-us/our-story

AND Wellcome Trust partnered with Gates multiple times, including for "exploring synergies between human and animal infections."

> **https://www.gatesfoundation.org/about/committed-grants/2014/05/opp1109338**
> **http://www.eliminatedengue.com/progress/index/view/news/1088**

Bill Gates-Funded Biotech Firm Claims GMO Mosquito Project a 'Success,' But Critics Cite Lack of Proof

> ***Oxitec this week said its first study of genetically engineered mosquitoes in the U.S. produced "positive" results, but critics said the experiment so far hasn't stemmed the spread of mosquito-borne illness.***
> ***https://childrenshealthdefense.org/defender/bill-gates-biotech-gmo-mosquito/***

Wellcome Trust and the Bill & Melinda Gates Foundation stand to profit handsomely from their investments in drug companies researching solutions for the pandemic.
Some say that raises critical questions around conflicts of interest, transparency and accountability.
https://childrenshealthdefense.org/defender/foundations-investments-influence-covid-research/

(6) Since the executive branch of our federal government has close connections the the Ukraine, where 46 biolabs have now been confirmed (many, if not all, established with U.S. help), it is incumbent upon us to discover whether using mosquitoes as a vector for transmitting the organism(s) responsible for future pandemics is being researched here in the U.S. and/or abroad. Since Covid-19 revealed that this very type of research has already taken place, it is critical to explore this issue.

(7) Since Rickettsia and Wolbachia are considered sufficiently similar that they have been co-studied in a variety of research AND since some of the organisms that are on the List of Select Human Pathogens are Rickettsia (Section 4-71A-23), it is also worth examining Wolbachia in much greater depth.

> ***"We also focus on the emergence of Rickettsia as a diverse reproductive manipulator of arthropods, similar to the closely related Wolbachia, including strains associated with male-killing, parthenogenesis, and effects on fertility."***
> **…….**
>
> **Phylogenetic analysis suggests multiple transitions between symbionts that are transmitted strictly vertically and those that exhibit mixed (horizontal and vertical) transmission.**
> ***Rickettsia* may thus be an excellent model system in which to study the evolution of transmission pathways. We also focus on the emergence of *Rickettsia* as a diverse reproductive manipulator of arthropods, similar to the closely related *Wolbachia*, including strains associated with male-killing, parthenogenesis, and effects on fertility.**
>
> **https://royalsocietypublishing.org/doi/10.1098/rspb.2006.3541**

From: scott werden
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Maui Forest Birds
Date: Monday, March 6, 2023 8:49:05 PM

Aloha,

I am writing in regards to the hearing before the DLNR-DOFAW on March 10, 2023 regarding critically endangered forest birds here on Maui.

Neither proposal is ideal but at this point this is the only remediation we have to prevent the extinction of some species of our forest birds. It is a very sad situation that these once thriving species are teetering but if we do not do something they will crash and that will be the end of them. I urge you to take the necessary steps to push these conservation efforts forward.

Mahalo,
Scott Werden
PO Box 345
Ha'iku, HI 96708

scott.werden@gmail.com

From: nora wheeler
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony
Date: Wednesday, March 8, 2023 2:44:33 PM

Subject: BLNR Meeting 3/10/23 9:15am Agenda Item C2 “Informational Briefing on the Hawai’i Forest Bird Extinction Crisis and DLNR’s Proposed Strategy to prevent their Extinction on Maui and Kauai”

I’m opposed to the planned biopesticide mosquito releases on Maui. This project is an experiment on our island home. There are serious risks, and the outcome is admittedly unknown.

The lab-reared mosquitoes will be infected with a different strain of *Wolbachia* bacteria, which could cause them to become more capable of spreading diseases like avian malaria and West Nile virus (bird and human). While state agencies and wildlife officials are hoping this novel strategy will prevent extinction of native birds, it may cause their extinction, and it could impact human health.

Scientific studies document the risks of horizontal transmission, increased pathogen infection, evolutionary events, population replacement, and accidental release of females (who bite and breed). This project would also have significant environmental consequences, including viewscape and noise disturbances, and impacts to the untrammeled, natural qualities of the wilderness character.

I do not accept the Environmental Assessment’s Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public health. I demand an Environmental Impact Statement (EIS).

NATIONAL TROPICAL BOTANICAL GARDEN
Chartered by Congress to Create a National Resource in Conservation, Research, and Education

March 8, 2023

Subject: Testimony on Agenda Item C-2 Informational Briefing on the Hawai'i Forest Bird Extinction Crisis and DLNR's Proposed Strategy to prevent their Extinction on Maui and Kauai

Aloha Chair Dawn Chang and members of the Board of Land and Natural Resources,

I am testifying today in strong support of the urgent action needed by DLNR and the many partner agencies and NGOS involved in the "Birds, Not Mosquitos" campaign to prevent the extinction of Hawai'i's beloved native honeycreepers.

I have been actively involved for most of my adult life in perpetuating Hawaii's unique natural and cultural resources and, in January of this year I retired after working at the National Tropical Botanical Garden for 47 years. During this time, I have discovered new species and watched species go extinct and I know first-hand from spending many decades in our native forests just how dire the current situation is for our endemic honeycreepers.

In 2016, I had the honor of co-chairing the National Host Committee for the International Union for the Conservation of Nature's World Conservation Congress which was held at the convention center in Honolulu. Attended by over 10,000 delegates from 192 countries the Congress inspired the world to look at how Hawaii was dealing with so many extreme conservation challenges. The adoption of the Hawaii Commitments (https://2016congress.iucn.org/news/20160911/article/iucn-congress-hawaii-commitments-set-sail-0.html) at the Congress has inspired conservation globally ever since.

One of the many remarkable outcomes from Hawai'i hosting the Congress in 2016 was the convening of leaders from around the world to focus mitigating the devastating impact that invasive alien mosquitos have had on our native endemic forest birds. Emergency Motion #104 was passed by the delegates and it in part:

> *"CALLS ON the Governments of the United States and the State of Hawai'i to urgently and fully implement the Hawaiian Bird Conservation Action Plan, Hawaiian Forest Bird Recovery Plan, and other relevant Hawaiian bird recovery plans, to seek additional resources from partners as are needed to avoid any additional bird extinctions and declines in the Hawaiian Islands, and to expedite the review, exploration and development of all appropriate techniques to control or eradicate invasive alien mosquitoes and other invasive alien species;"*

The fact that thousands of conservation leaders from around the world recognized that Hawai'i was on the brink of losing part of our unique biocultural heritage helped inspire us to action in ways we had not been willing to take before. The briefing you just received documents the journey from 2016 to today and the importance of the multi-agency partnership / effort now called *Birds, Not Mosquitoes*.

I have been honored to be part of this effort and to have hosted meetings on Kaua'i to spread the word and build community support. Everywhere we have been met with support and once the public understood this was not a "gene-drive" technique using genetically modified mosquitos but instead was using a naturally-occurring bacteria that commonly infects many insect species even the skeptics have become supporters.

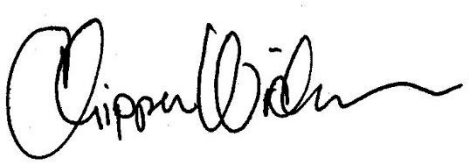
The combination of an effective captive breeding program and the Incompatible Insect Technique (IIT) approach gives us the very best chance of preventing the extinction of the ʻakikiki and the kiwikiu as well as other species of honeycreepers that are not as close to extinction as these two extreme cases. The best time to protect a species is before it become extremely rare so this effort will have the added benefit of helping many other forest birds beyond the ʻakikiki and the kiwikiu.

While it will be expensive and logistically challenging to keep up the release of the infected male mosquitos year after year for the foreseeable future, it is a small price to pay if we can prevent the extinction of these incredible birds. The infusion of funds from a Green Fee for visitors could become a reliable source of fund that could sustain these efforts in the years ahead!

Since DLNR is the lead agency in this collaborative effort, I strongly urge all of you as members of the Board of Land and Natural Resources to not only provide your full support to DOFAW but to echo the same urgency that the globally delegates had when they urged Hawaii to "… expedite the review, exploration and development of all appropriate techniques to control or eradicate invasive alien mosquitoes and other invasive alien species" that are threatening our native forest birds!

I leave you with an ʻolelo noʻeau that has inspired me to devote my career to protecting nā me Hawaiʻi apau: I ola ʻoe, I ola mākou nei – when you thrive then I thrive! For Hawaii to thrive in the 21st century we need to ensure the survival of our native ecosystems and the many species that call them home!

Mahalo a nui loa for the chance to testify today in support of our native forest birds.



Chipper Wichman, President Emeritus
National Tropical Botanical Garden
Kalāheo, Kauaʻi, Hawaiʻi

From: Evelyn
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] Testimony for May 10 BLNR meeting
Date: Thursday, March 9, 2023 8:55:53 AM

Aloha, I am writing to share my emphatic and complete support for DLNR's proposal to prevent extinction of native forest birds, some of which are close to extinction, by using mosquito birth control, or Incompatible Insect Technique (IIT), to suppress mosquito populations.

I am confident in the scientific work, the EA and the conservation organizations involved in this project and I strongly encourage the BLNR to support and help to execute this project.

Evelyn Wight
Volcano, Hawaii Hawai'i's forests. Furthermore, this action would not introduce any new

organisms to Hawai'i. Wolbachia, the genus of intracellular bacteria naturally occurring in Culex quinquefasciatus, prevents reproduction when mating male and female mosquitoes carry incompatible strains.
We agree with DLNR that an Environmental Assessment (EA) is appropriate for this project as there is no significant environmental impact expected associated with IIT suppression of Culex quinquefasciatus. TNC is confident that the risks and impacts assessed by DLNR and the National Park Service in the East Maui Mosquito Suppression EA are comprehensive of this project and we encourage you to support this strategy.
If we do not take action now, we will see the extinction of multiple native bird species within ten years. TNC, DLNR and many members of Hawai'i's conservation community have dedicated significant time and resources to provide safe habitat for Hawai'i's native forest birds through management of preserves including fencing, ungulate removal, weed control, native tree restoration, and predator control. Avian malaria vector control through mosquito suppression is the key piece that can reverse the downward population trends our birds are experiencing while keeping them in their forest home. Please support this critical and safe initiative before it's too late for our birds.
Mahalo for your support and stewardship of Hawai'i's natural resources.

From: Gary Wong
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2: "DLNR"s Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date: Tuesday, March 7, 2023 10:09:28 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan require detailed, comprehensive studies and documentation of the impacts to our native birds, wildlife, environment, and public, health. I Demand an Environmental Impact Statement (EIS).

Rita Wong

From: Aimee Azuremare
To: DLNR.BLNR.Testimony
Subject: [EXTERNAL] OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date: Tuesday, March 7, 2023 6:09:44 PM

My name is Kachina Woolger and I live in Kapahi on Kauai

I'm writing to tell you I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Sincerely Kachina Woolger

Hauiki Rd
Kapaa 96746

From:	Julia Wurst
To:	DLNR.BLNR.Testimony
Subject:	[EXTERNAL] Subject: OPPOSE Agenda Item C2 : "DLNR's Proposed Strategy to prevent Bird Extinction on Maui & Kauai"
Date:	Tuesday, March 7, 2023 6:53:49 PM

I DO NOT accept the Environmental Assessment's Anticipated Finding of No Significant Impact (DEA-AFONSI). The scope, risks, and experimental nature of the plan ***require detailed, comprehensive studies and documentation*** *of the* ***impacts to our native birds, wildlife, environment, and public health. I Demand an Environmental Impact Statement (EIS).***

Let's be real! You have no plan if anything goes wrong. Remember Jurassic Park..."Life finds a way." This release could completely ruin wildlife and human life and the truth is no one can reassure the residents of Maui and Kauai that everything will be fine. Please do better for the sake of every living thing who resides here.

Mahalo,
Julia Wurst
Makawao, HI