

TO THE RESCUE

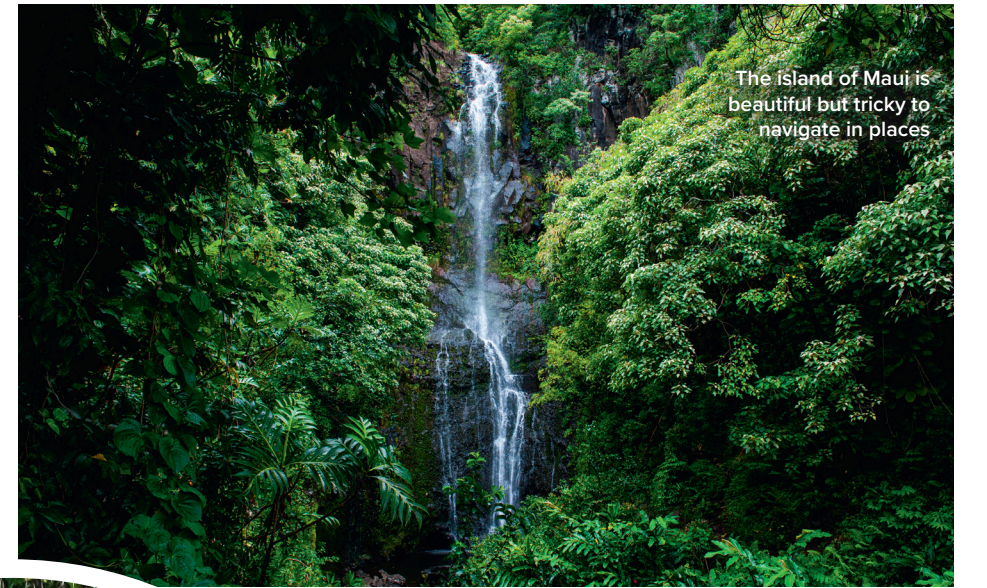
Mosquitoes have nearly wiped out Hawaii's native birds. Now, the insects could be their last hope.

Words and photos by RYAN WAGNER

The rare kiwikiu is now restricted to a small area on the Hawaiian island of Maui



A helicopter takes the field team up the slopes of Maui's Haleakalā Volcano.



The island of Maui is beautiful but tricky to navigate in places.



Nets are used to harmlessly ensnare birds.



Kiwikuis are also referred to as Maui parrotbills.

LITTLE YELLOW HELICOPTER HOVERS ABOVE Maui's vivid green slopes. The co-pilot's voice crackles over the intercom. "Drop!" he shouts. A biodegradable pod, the size and shape of an ice-cream cone, pops out of a plexiglass chute and tumbles towards Earth – an insect Trojan horse carrying 1,000 male mosquitoes. The pod breaks open upon impact, releasing a small black cloud of buzzing insects.

"Mosquito releases are underway on east Maui," says a triumphant Hanna Mounce. As programme manager for the Maui Forest Bird Recovery Project, part of her job is to eradicate mosquitoes. To do that, she is releasing millions more. Mosquitoes were accidentally introduced to the Hawaiian Islands in the 1800s. Alongside habitat loss and invasive predators such as cats, rats and mongooses, they contributed to an archipelago-wide collapse of native bird populations. Mosquitoes transmit avian malaria, a disease Hawaiian

birds are defenseless against. A single mosquito bite can be fatal. Of the more than 50 recorded species of Hawaiian honeycreeper – a group of small, colourful songbirds found nowhere else on Earth – just 17 persist across the Big Island, Maui, Kauai and Oahu. The Hawaiian Islands are often referred to as the 'Bird Extinction Capital of the World,' a moniker Mounce finds distasteful, given the number of people working to save the archipelago's remaining birds. With help from a multi-agency partnership called Birds, Not Mosquitoes, Mounce is implementing a kind of mosquito birth control that she hopes will wipe out the invasive insects.

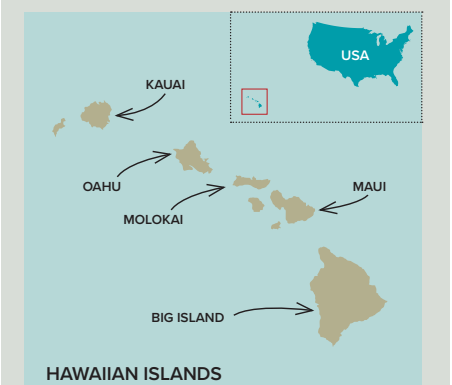
Enter *Wolbachia*, a naturally occurring bacteria requisite for mosquito reproduction. Only mosquitoes with compatible strains of *Wolbachia* can reproduce. Eggs sired by laboratory-reared males (which don't bite)

ABOUT THE AUTHOR



Ryan Wagner is a PhD student at Washington State University and a science photojournalist. His writing and photography have been featured in *The Guardian*, *Nature* and other publications.

Where is Hawaii?



Hawaii became the 50th state of the USA in 1959 and comprises a group of volcanic islands in the Pacific Ocean, 3,857km south-west of San Francisco. Honolulu, the capital, is located on Oahu.



The team collect and transport kiwikiu that will be used for captive breeding

infected with an incompatible strain of *Wolbachia* will fail to develop, causing the island's mosquito population to crash in a single generation.

Wolbachia has been used to suppress mosquitoes in Australia, Singapore, Brazil, Florida, California and Texas, but it has never been used in Hawaii or for bird conservation. Mosquito birth control could be effective within the next two to three years, but the true measure of success will be an increase in native bird populations, says Mounce.

WOLBACHIA COULD HELP to save Maui's most critically endangered birds, including the 'i'iwi (pronounced ee-ee-vee), 'alauahio (allow-a-hee-o), 'amakihi (amah-kee-hee), and 'akohekohe (akohe-kohe). But salvation may arrive too late for the kiwikiu (kee-vee-kyoo), a little, yellow-green bird with a hooked, parrot-like bill. With just over 100 kiwikiu remaining (down from around 500 a few years ago), the species could become extinct in as little as three years. "We are watching them disappear before our eyes," says Mounce.

Before mosquitoes arrived on Maui, the kiwikiu could be found across the island from sea level to 2,000m in elevation, and on the island of Molokai. Today, the kiwikiu is restricted to a narrow ring of habitat – a 'lei', says Mounce, referring to the familiar Hawaiian garland – on the slopes of Maui's Haleakala volcano, too high and cold for mosquitoes to reach.

With such limited habitat, a natural disaster such as a hurricane could easily wipe them all out. "So, we built a forest," says Mounce. Tree by tree, her team transformed the west slope of Haleakala from a cattle ranch into a rainforest.

In 2019, 14 kiwikiu were reintroduced to the newly established Nakula Natural Area Reserve. Birds that had never fed on koa trees before immediately began to use their curved bills to extract wood-boring insect larvae. "They used the habitat really well,"

"Of the more than 50 recorded species of Hawaiian honeycreeper, just 17 persist across the islands"



A plexiglass chute directs the biodegradable pods



Each pod is filled with 1,000 male mosquitoes infected with *Wolbachia*



A kiwikiu is offered protein and electrolytes to boost its strength for the trip to the captive breeding facility

says Mounce. "If it hadn't been for the mosquitoes, Nakula would have been great."

As Mounce's team transformed Nakula, climate change was transforming Maui, allowing mosquitoes to penetrate elevations that had previously been inaccessible. After two weeks, the reintroduced kiwikiu were dead, having succumbed to malarial infection. "It was heartbreaking. There aren't even words to describe it," says Mounce. After the failed reintroduction, Mounce was out of ideas. "You could have given me \$10 million and I wouldn't have known what to do with it. Before *Wolbachia* came on board, we had no tools."

As the islands continue to warm, the last high-elevation refuges could soon be swamped with mosquitoes. "The reintroduction unveiled the avian disease issue that we had been facing for a while, but thought we had more time to deal with," says Laura Berthold, avian research field supervisor with the Maui Forest Bird Recovery Project.

"In the wild, all [kiwikiu] are doing is dying," says Berthold. "We need to put them

somewhere we can protect and save them." Berthold and Mounce decided to create a captive-breeding population to safeguard the kiwikiu until mosquitoes are controlled.

"Bringing birds into captivity isn't something any of us want to be doing," says Sonia Vallocchia, a field biologist with the Maui Forest Bird Recovery Project. "But this is the kiwikiu's last chance."

ONE EARLY MORNING IN LATE January, I join Vallocchia and her field team to help catch a kiwikiu. We don flight suits and helmets for the short helicopter ride up the mountain and land near a rustic cabin that will be our basecamp. A wooden sign hangs above the doorway that reads 'E komo mai hale o po'ouli.' Welcome to the home of the po'ouli (poh-oh-U-lee), a name that hangs heavily over our search for the kiwikiu. The po'ouli was Maui's most recent avian casualty. The last individual died in 2004, after a failed captive-breeding programme, a stark reminder of the kiwikiu's potential fate if our capture effort fails.

For most, Hawaii calls to mind warm, sunny beaches and blue surf, but at 1,800m the air becomes brisk and damp. Frequent storms turn the loose volcanic soil into a mudslide. "Prepare to start every day with an uphill hike," says Vallocchia. I shuffle behind the team, bracing myself against trees like a graceless Tarzan. As we approach our destination, we scale a steep gulch on a rickety ladder lashed precariously to the bare rocks.

Vallocchia strings what looks like a fine-mesh volleyball net across a gap in the forest. Standing perpendicular to the net, it is nearly invisible. We sit in hushed anticipation, scanning the canopy for movement. Vallocchia begins to play a recording of the kiwikiu's song, a soft *kiwi-kiu, kiwi-kiu*. Her eyes widen as a yellow-green bird flies very close to the net, then over it at the last moment. I exhale, but Vallocchia isn't fazed. She lures the kiwikiu back with the recording.

Finally, the bird hits the net, fluttering slightly as Vallocchia quickly untangles him. He nips her finger with his oversized beak, drawing blood, but Vallocchia doesn't seem to notice. Using a small needle, she pricks a



On arrival, a kiwikiu's vital statistics are noted down



Adult kiwikius grow up to 15cm long, about the size of a dunnock



Aviaries lined up at the Maui Bird Conservation Center

“As the islands continue to warm, the last high-elevation refuges could soon be swamped with mosquitoes”

vein under the bird's wing to test for malaria and places him in a small transport box for the hike back to camp. After three weeks in the field, Vallocchia and her team have caught eight kiwikiu, roughly six per cent of the world population. It's a start.

We airlift the kiwikiu to the Maui Bird Conservation Center in Makawao. Hanna Bailey, lead aviculturist, weighs each bird, treats them for malaria, and offers them a lunch of mealworms and native berries. Bailey has hands-on experience with more than 300 species of birds in captivity, but she admits matchmaking can be difficult. “I am no magician,” she says. “I can't wave my hands and make birds breed.” In the wild,

female kiwikiu depend on their mate to feed them. In captivity, however, they often pair-bond with the food pan; it seems that a mate is superfluous.

To encourage the birds to couple up, Bailey places eligible singles in 'lovers' lane', a set of four aviaries where females can choose between three potential mates. Once paired, they will be upgraded to the couple's suite, a joint aviary with nesting material.

Kiwikiu reproduction is agonisingly slow. Pairs lay a single peanut M&M-sized egg every year and fledglings are dependent on their parents for up to 18 months. Bailey could artificially incubate the eggs, encouraging the parents to lay a replacement,

but she opts for the natural approach. “An egg is always better off under something with feathers,” she says.

Captivity, however, could risk more than just extinction. The kiwikiu could lose their natural behaviours, dialects and parental instincts. For example, the captive-reared kiwikiu translocated in 2019 ended up singing like the palila (*pah-lee-luh*), a native of the Big Island, which was housed next door at the conservation centre. “They may need to relearn their culture,” says Bailey. “And that depends on how many birds remain in the wild to learn from.”

The songs of wild kiwikiu may also be changing. With fewer and fewer kiwikiu

singing in the forest, fledglings are mimicking more abundant birds such as the Hawaii 'amakihi and introduced Japanese white-eye.

But a forest with any birdsong may be a cause for celebration. Bailey thinks of Guam, where invasive brown tree snakes have wiped out most of the native birds, rendering the forests silent. “Conservation means not having that happen anywhere else.”

FOR MOUNCE, PRESERVING BIRDS and preserving Hawaii are synonymous. “If we lose the birds, we no longer have anything dispersing seeds or pollinating. The forests would just stop regenerating completely.” Where native forests have been cleared for sugar-cane plantations, now long fallow, the volcanic soil is easily blown out to sea, smothering coral reefs. If mosquito birth control is successful, birds restricted by disease to

mountain slopes could return to lower elevations, spreading the seeds of native plants and helping the forest to regenerate.

Mounce imagines a future where Maui is once again cloaked in lush rainforest and even back gardens are planted with native koa, 'ohi'a and māmane. The kiwikiu and other brilliantly coloured Hawaiian birds could then safely forage on kanawao berries and lehua flowers, the buzz of mosquitoes a distant memory.

Inside a large aviary at the Maui Bird Conservation Center, a kiwikiu preens his yellow-green feathers. At just over 1,000m in elevation, malaria-carrying mosquitoes hum just outside a thin, insect-proof screen. Nowhere else in the world is the line between survival and extinction clearer. “If we lose the kiwikiu, we want to be able to say we did everything we possibly could,” says Mounce. “This isn't a job you can walk away from.”

HONEYCREEPERS

ID GUIDE

Honeycreeper species

Five honeycreepers that illustrate the great diversity among these songbirds

'Tiwi

The 'iwi is the most recognisable honeycreeper, found only on Hawaii, Kauai, and Maui, and numbers 250,000-500,000. Its status is Vulnerable.



'Alauahio

Endemic to Maui, this straight-billed honeycreeper numbers around 60,000 individuals, with a conservation status of Endangered.



'Amakihi

Found only on Hawaii, Maui, Kauai, Oahu, Molokai, this species numbers 800,000, and is Endangered on Kauai and Near Threatened on Oahu.



'Akohekohe

This ornate honeycreeper is endemic to just 20km² of habitat on Maui. At fewer than 2,000 individuals, it is Critically Endangered.



'Apapane

The most common honeycreeper is found on Hawaii, Maui, Kauai, Oahu, Molokai and Lanai. With over a million individuals its status is Least Concern.



AKOHEKOHE: MINDEN PICTURES/ALAMY