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‘ELEPAIO

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´Akeke´e (*Loxops caeruleirostris*) Foraging Techniques: Targeting psyllid nymphs in ´ōhi´a galls

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The ´akeke´e (*Loxops caeruleirostris*) or Kaua´i ´ākepa is a small (10-12 g), insectivorous forest bird endemic to Kaua´i. The ´akeke´e is a Hawaiian Honeycreeper (Fringillidae) and is currently listed as a critically endangered species (Birdlife International 2016). These birds were once widespread on Kaua´i in native forests of the Alaka´i swamp, upper Waimea, and Kōke´e areas above 1,000 meters elevation (Foster et al. 2004, Lepson and Pratt 1997, USFWS 2003). The ´akeke´e population has declined drastically, with a 2012 population size estimated at 945 individuals (95% CI = 460 to 1547) (Paxton et al. 2016).

´Akeke´e are sexually dichromatic with adult females having slightly duller yellow-green plumage compared to the males. They have short, bluish bills with a lower mandible that is slightly offset to one side, resulting in a bill with lateral asymmetry or “cross bill,” a characteristic that is shared with the Hawai´i ´ākepa (*Loxops coccineus*). ´Akeke´e are ´ōhi´a (*Metrosideros polymorpha*) specialists and tend to forage in the canopy, and were observed to feed primarily on arthropods (e.g., spiders, psyllids, and caterpillars) using their cross bills to open terminal leaf buds (Benkman 1989, Lepson and Pratt 1997, USFWS 2010). Their distinctive behavior of using their specialized bill to methodically separate close growing leaves and open leaf buds may be used to identify the species in the field; and is a foraging behavior similar to that used by other cross bills (*Loxia* spp.) which open conifer cones in search of seeds (Lepson and Pratt 1997, Vanderwerf 2012).

´Akeke´e are currently being reared at the Keauhou Bird Conservation Center (KBCC) in Volcano on Hawai´i Island, and Maui Bird Conservation Center (MBCC) in Makawao, on Maui Island as part of a conservation breeding program. At both KBCC and MBCC, branches of ´ōhi´a are regularly provided as fresh foraging substrate for these birds. ´Ōhi´a trees across the state of Hawai´i often create galls in response to infestation by parasitic psyllid species in the genus *Pariaconus* (formerly *Trioza*) (Percy 2017). The ´ōhi´a psyllid adult females are known to lay their eggs in the tissue of young ´ōhi´a leaves. After the eggs hatch, the nymphs feed on the leaves and secrete substances that stimulate abnormal plant growth, or galls, around the nymphs. Protected by the ´ōhi´a gall, psyllid nymphs will remain within the gall until they are ready to mature; following their final molt they emerge from the gall as adults. Often, the foliage on branches provided to ´akeke´e possess varying levels of ´ōhi´a psyllid galls.

We observed foraging behavior of three ´akeke´e, two females and one male on ´ōhi´a branches provided for them at KBCC and MBCC. All three of these birds were adults that were hand-reared from eggs collected from the wild on Kaua´i. Observations were made on one female and one male at KBCC, and one female and one male at MBCC (the male was transferred from KBCC to MBCC). We conducted over 16 hours of observations from September 2016 to March 2017 and detected a unique set of foraging techniques by which both males and females use their specialized bill to remove and consume psyllid nymphs from

Figure 1. **(A)** Top left: ʻAkekeʻe male studbook AE007 demonstrating technique #1 Direct: slicing open gall to extract psyllid nymph at KBCC. **(B)** Top right: ʻAkekeʻe female studbook AE006 demonstrating technique #2 Leaf Cuter: using bill to cut into edge of leaf and psyllid gall to extract psyllid nymph at KBCC. **(C)** Bottom left: ʻAkekeʻe female studbook AE006 demonstrating technique #3 Leaf Picker: picking leaf off branch to take to another branch to then extract psyllid nymph at KBCC. **(D)** Bottom right: ʻAkikiki female studbook AI024 attempting to open ʻōhiʻa gall at KBCC.

ʻōhiʻa galls. These techniques included (1) *Direct*: ʻakekeʻe use their bills to directly slice open the top of the gall and pull out the psyllid nymph (Figure 1A); (2) *Leaf Cutter*: ʻakekeʻe use their bill to cut into the edge of a leaf and then enter the psyllid gall, pulling out the psyllid nymph (Figure 1B); and (3) *Leaf Picker*: ʻakekeʻe use their bill to first cut a leaf off the branch (Figure 1C), then fly over to a different branch carrying the leaf with them, hold the leaf down on the branch with their foot, and pry open the galls with their bills to extract the nymph.

When ʻakekeʻe (one female and one male) were provided ʻōhiʻa at KBCC they immediately targeted the psyllid galls and spent most of their time foraging on them. When the second female ʻakekeʻe and one male ʻakekeʻe (moved from KBCC) were provided with ʻōhiʻa at MBCC they appeared interested in the psyllid galls, but also spent a substantial amount of time foraging on other portions of the ʻōhiʻa branches, particularly the leaves and leaf buds in search of other arthropods. This difference in foraging techniques from KBCC to MBCC may be due to the difference in abundance of ʻōhiʻa psyllid galls the ʻōhiʻa provided. It may also be due to individual differences because of small sample size or alternative prey abundance on other branches. On Hawaiʻi Island, through anecdotal observation, visual inspection revealed that many of the leaves provided were covered with galls, while on Maui, during the same period of time, there were far fewer psyllid galls covering ʻōhiʻa leaves.

Other native Kauaʻi forest birds, like the ʻakikiki have a different bill structure than that of the ʻakekeʻe. We observed 12 ʻakikiki at KBCC and MBCC over 20 hours. ʻAkikiki predominantly foraged along the bark of the ʻōhiʻa and in the leaves and crowns of branches. They sometimes attempted opening ʻōhiʻa galls but their attempts were generally not successful (Figure 1D).

The technique of feeding on psyllid nymphs by opening ʻōhiʻa galls may be an "innate" behavior, as KBCC and MBCC ʻakekeʻe were not exposed to wild ʻakekeʻe who may have previously developed this foraging behavior. Their specialized bill structure may be a unique adaptation allowing the ʻakekeʻe to not only to be able to pry open leaves and leaf buds, but also to specifically target and cut open the tough exterior of psyllid galls on ʻōhiʻa. Previous studies have demonstrated that other avian species such as Black-capped Chickadees (*Poecile atricapillus*) and House Finches (*Haemorhous mexicanus*) consume psyllid nymphs within galls on hackberry leaves (*Celtis occidentalis*) (Leatherman 2016). However, to our knowledge, this foraging behavior has not been previously observed or reported for any species of Hawaiian bird. The Hawaiʻi ʻākepa share a similar bill structure with the ʻakekeʻe, and have been documented to use their specialized bill to pry open leaves and flower buds including koa phyllodes and seed pods (Banko et al. 2015). It would be interesting to determine whether Hawaiʻi ʻākepa prey on psyllid nymphs within galls as well.

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We thank the San Diego Zoo Global for allowing us to carry out these observations at their facilities. We are also grateful to the staff and interns of the Keauhou Bird Conservation Center and the Maui Bird Conservation Center, especially Bryce Masuda, Lisa Komarcyzk, Jennifer Pribble, Lynne Neibaur, Donnie Alverson, and Corina Sanchez for their ongoing help and support. Thank you also to Lisa Cali Crampton and Justin Hite for observational data on ʻakekeʻe on Kauaʻi and ʻōhiʻa psyllid gall prevalence. This work was partially funded through CREST award #0833211 from the National Science Foundation. Funding for the ʻakekeʻe conservation breeding program was provided by the U.S. Fish and Wildlife Service, Hawaii Division of Forestry and Wildlife, and San Diego Zoo Global, with contributions by the American Bird Conservancy and anonymous donors.

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"Important Plants for Nectarivorous Birds in Continuous and Naturally Fragmented Forest on Hawaii Island"

Meet the Mōlī: A review of the new children's book *A Perfect Day for an Albatross* by Caren Loebel-Fried

By Wieteke Holthuijzen

Laysan Albatross, known as mōlī in Hawaiian, are spectacular birds of the sea, nearly mythical in terms of their nomadic and mysterious lives in the open ocean and their intricate courtship dances on land. Although albatross are often metaphorically connoted with burdens of the heart and mind, a new book written and illustrated by Hawai'i artist Caren Loebel-Fried changes the perspective on albatross and invites the reader into the fascinating world of these seafaring birds. Although written for younger schoolchildren (grades 1-3), *A Perfect Day for an Albatross* is a unique, engaging, gorgeous, and informative book that readers and audiences of all ages will enjoy and cherish.

The book opens with Mālie, a Laysan Albatross nesting on Midway Atoll National Wildlife Refuge (NWR), a secluded seabird colony located at the end of the Northwestern Hawaiian Islands and part of one of the world's largest protected areas—the Papahānaumokuākea Marine National Monument. Although most associate this set of remote islands with the Battle of Midway, the reader steps into a different world, one filled with thousands upon thousands of seabirds. Mālie, surrounding by more than a million fellow breeding albatross, carefully tends to her single egg in a busy and bustling seabird colony. She, too, hatched on this isolated atoll, then spent many years at sea, learning how to forage and soar throughout the North Pacific before returning "home" again to contribute to the next generation of albatross. Complimented by vibrant, full-color block prints, Caren Loebel-Fried integrates basic aspects of albatross life history and biology and places the reader alongside these seabirds, giving us an opportunity to learn from and participate in their day-to-day lives. For example, when Mālie returns to Midway Atoll NWR and meets her future mate, Kumukahi, each part of their elaborate courtship dance is illustrated in detail, step by step. Add in your own "sky moos," "bill claps," and some "scapular action" and you will be dancing along with the albatross yourself!

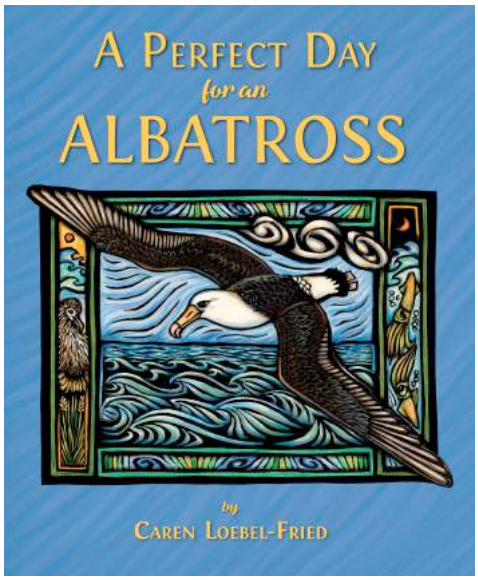
Mālie's day is full of commotion and interactions, from neighborly nesting albatross to blustery storms. Each page, each illustration is a journey in of itself and captures the intense and dense life on Midway Atoll NWR. As Mālie incubates her egg, she pulls in nesting material from a native plant species (bunchgrass - kāwelu); underground, a Bonin Petrel (a burrowing seabird) rests in its burrow. Perhaps one of the most beautiful parts of the book occurs when Mālie is given a break from her incubating duties (by her partner, Kumukahi), so she takes off for the sea for a well-deserved stretch and much-needed meal. The reader flies along with Mālie over the open ocean; you can almost feel the sea when Mālie takes a bath and preens herself in the water, ridding herself of mites and dust. After a hearty meal at sea, Mālie departs into the night sky, into the air—returning to her natural element. As a closing, and such a perfect ending to the perfect day for an albatross, Mālie remarks, "I could fly forever, dreaming forever, over the endless beautiful sea."

A compelling story, rich artwork, and engaging content make for an incredible book—and Caren Loebel-Fried has certainly done so with *A Perfect Day for an Albatross*. For any child (and for the child in all of us), this book is a beautiful introduction to the wide and wild world of albatross, to the feelings, sounds, and sights of a bustling seabird colony. A common thread throughout the book is Caren Loebel-Fried's careful attention to detail—or more specifically, translating years of research and observation of these elusive seabirds into an engaging format that all can understand. Even seasoned seabird enthusiasts will find something new to learn in this book! As a bit of background, Caren Loebel-Fried spent five weeks on Midway Atoll NWR counting and researching albatrosses; in addition to innumerable hours reading peer-reviewed literature and consulting with seabird biologists, Caren has taken considerable effort to ensure that her book is certainly biologically accurate.

In addition to the story about Mālie's day, Caren Loebel-Fried also includes several valuable pages that provide more information about Laysan Albatross, Midway Atoll NWR, seabird ecology, and tips

on how readers can take steps to conserve and protect the oceans, coral reefs, and islands that are critical to the survival of albatross and millions of other marine species. As a special note to educators and teachers, *A Perfect Day for an Albatross* also comes with a (free!) comprehensive and impressive educational guide that covers a wide variety of topics, from albatross habitat to nesting behavior to plastic pollution in oceans; you access these materials at the following website (http://www.birdsleuth.org/perfectday/). This book is published by Cornell Lab Publishing Group, part of the prestigious Cornell Lab of Ornithology; be sure to check out the book's back matter, which includes a Bird QR link to watch live albatrosses on the Cornell Lab of Ornithology HD cam in Hawai'i.

Anyone who has had the great fortune to visit Midway Atoll will agree that Caren Loebel-Fried captures the "magic" of Midway in *A Perfect Day for an Albatross*. We may not necessarily all have the great fortune and luck to visit Midway, but Caren Loebel-Fried offers her readers the next best thing—to dance and soar with albatross from page to page in a stunning, inspirational, and educational book.



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Press Release: ʻIʻiwi Receives Protection under the Endangered Species Act

By USFWS Pacific Region

This press release is a reprint from the USFWS Pacific Region tumblr webpage from September 2017

Image of ʻIʻiwi. Photo Credit: Dan Clark/USFWS.

Once one of the most common forest birds in the Hawaiian Islands, the ʻiʻiwi, also known as the scarlet honeycreeper, will now be protected as a threatened species under the Endangered Species Act.

In the past, ʻiʻiwi could be found from the coastal lowlands where they foraged for food to the high mountain forests where they nested. Today, ninety percent of the ʻiʻiwi population is confined to a narrow band of forest on East Maui and the windward slopes of the island of Hawaii, between 4,265 and 6,234 feet (1,300 and 1,900 meters) in elevation. The birds are virtually gone from the islands of Lanai, Oahu, Molokai and west Maui, while the population on Kauai is in steep decline.

"In recent years, the ʻiʻiwi population has been in sharp decline, due to threats from habitat loss, invasive species and avian diseases, particularly avian malaria," said Mary Abrams,

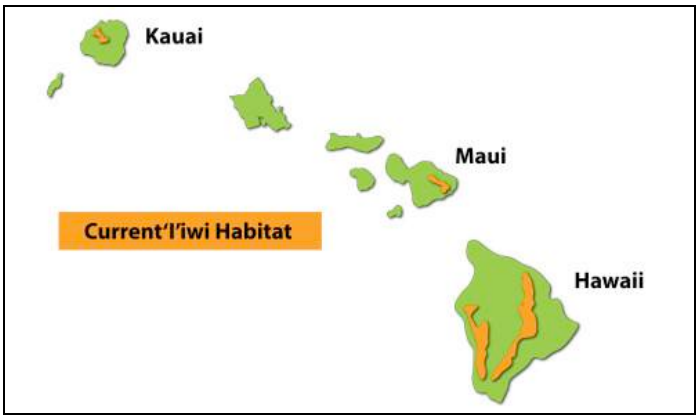

Image of a map that shows approximate ranges and should not be used for planning purposes. Photo Credit: USFWS 'I'iwi press release 2017.

project leader for the Service's Pacific Islands Fish and Wildlife Office. "These threats have affected all forest birds, not just the 'i'iwi. Conservation that benefits the 'i'iwi will undoubtedly benefit other Hawaiian forest birds."

Avian malaria, carried by invasive mosquitos, is the primary driver in the decline in of the 'i'iwi population, and has already caused the decimation of dozens of other Hawaiian forest birds. The disease kills approximately ninety-five percent of infected 'i'iwi. Mosquitos, which are not native to the Hawaiian Islands, breed and thrive at lower and warmer elevations where they infect birds like the 'i'iwi with avian malaria and pox.

"'I'iwi have virtually disappeared from any habitat where mosquitoes are found," said Abrams. "This has caused their range to shrink dramatically – they are almost entirely limited to higher elevation 'ōhi'a forests for their habitat, dietary, and nesting needs."

Higher and cooler elevation 'ōhi'a forests, where mosquitoes do not thrive, remain the only habitat for the 'i'iwi, but even those areas are under threat. As temperatures rise, mosquitoes, and the avian diseases they carry, are able to survive at higher elevations and spread upwards into the mountains, further constricting the 'i'iwi's range

'I'iwi are dependent for their survival on forests of native 'ōhi'a. On the island of Hawaii, home to 90 percent of the remaining 'i'iwi population, those 'ōhi'a forests have been under attack from rapid 'ōhi'a death, an invasive tree pathogen.

"Working with the state, our conservation partners and the public will be crucial as we work to recover the 'i'iwi, said Abrams. "The Service is committed to building on our record of collaborative conservation to protect Hawaii's native species."

The Service's final listing rule will be published in the Federal Register on Sept 20, 2017, and will become effective on October 20, 2017. Next steps include development of a recovery plan, which will be bolstered by input from other federal and state agencies, other conservation partners and the public.

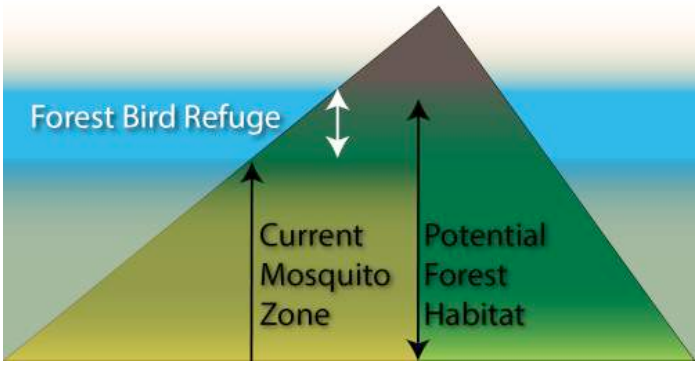

Image of Forest Bird Refuge. Photo Credit: USFWS 'I'iwi press release 2017.

Image of 'I'iwi in ohia lehua. Photo Credit: Raymond Lara/USFWS.

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Thank you for your concern and commitment to protecting Hawaii's native wildlife and ecosystems.

Aloha Hawai‘i Audubon Society Leadership

The Society wishes to gratefully acknowledge the efforts of outgoing Board members **Dr. Phil Bruner** and **Anna Pickering** who have completed their terms of service to the HAS Board for the past three years. Mahalo nui loa for your leadership and insights.

Continuing to serve are Board members **Wendy Kuntz, Alice Roberts, Anthony Leiggi,** and **Rich Downs**. Mahalo nui loa for your ongoing efforts. As always a warm welcome to our HAS President **Linda Paul**, Vice President **Elizabeth Kumabe-Maynard**, and Executive Director **Wendy Johnson** for their continued help.

E komo mai and Welcome to our newest Board member, **Pat Moriyasu**, who will be serving a one-year term.

Image of Baby White Tern. Photo Credit: Eric Vanderwerf.

Upcoming Events, Field Trips, & Volunteer Opportunities

For full descriptions of our Events, Field Trips and Volunteer Opportunities, go to our website: http://www.hawaiiaudubon.org/

VOLUNTEER OPPORTUNITIES

Freeman Seabird Preserve 2018 Fieldwork Season
Seeking Volunteers for Habitat Restoration!
8:30am-11:30am, Every Saturday morning
JAN through MAR 2018

In November and early December, Wedge-tailed Shearwater adult birds and chicks leave the Freeman Seabird Preserve at Black Point to forage at sea for several months before returning in the latter part of March to nest.

Volunteers are needed for fieldwork at the site on Saturday mornings from 8:30am-11:30am beginning January 6th. There will be no Habitat Restoration activities on January 13 due to traffic congestion from the Sony Open golf tournament at the Waialae Country Club. Activities will include maintenance of native plants and man-made landscape features, along with removal of invasive plants, trash and debris. Other dates and times can be arranged for groups wishing to contribute their time in an effort to preserve rare Hawaiian coastal vegetation and seabird nesting habitat.

If you would like a ride to the Preserve, please meet at the Paikau St. side of Triangle Park (other park boundaries are Diamond Head Road and Kahala Avenue) at 8:15. Habitat restoration activities will take place from 8:30-11:30 a.m.

If you prefer to start later, please park outside the BP gate, or in surrounding neighborhoods (Papu Circle, Aukai Ave.). Walk to Black Point Road and turn uphill, then use the pedestrian gate to walk down to the Freeman Seabird Preserve.

If you would like to participate, please contact HAS Board Member Alice Roberts at (808) 864-8122 or mermaidshi@aol.com. Please include name(s), ages of anyone under 18, phone number and/or email address. Plan on bringing drinking water, sun and rain protection, gloves, weeding tools, clippers and loppers.

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