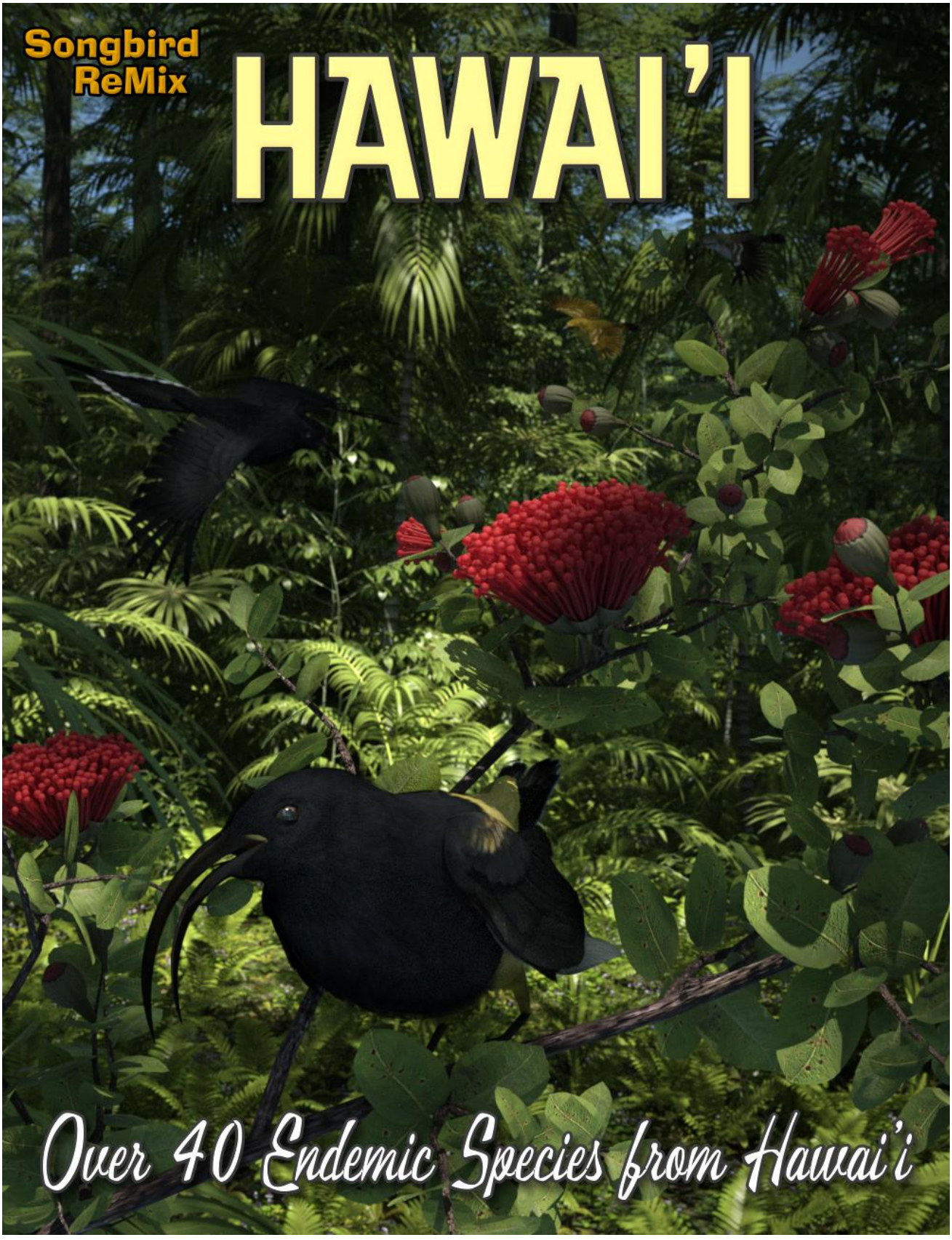


Avian Models for 3D Applications by Ken Gilliland

Songbird ReMix

Endemic Birds of Hawai'i

Manual

Field Guide

Introduction

Hawai'i has many of the most unique and usual bird species on the planet. Over half of the known bird species on Hawai'i evolved from the finch. Of the 71 known species of endemic Hawaiian bird, one-third are extinct and two-thirds of the remaining living species are endangered or threatened. This collection has almost half of the known species to inhabit Hawai'i (35 species, 41 birds in all).

The following birds and more are included in this set: The incredible extinct honeycreepers such as the Hawai'i mamo who's feathers adorn the cape of the great Hawaiian King, Kamehameha and the richly colored kakawahie. The Hawaiian Goose, the nēnē and the iwa (Great Frigatebird) that are perfect for coastal images. And the elusive woodpecker-like 'akiapola'au and vibrant scarlet 'i'iwi are awaiting a limb to perch on in your images set deep in the interior rain forest.

Whether you choose to create art with a message or you are simply looking for realistic and attractive birds for your imagery, this package will easily fulfill those needs.

Overview and Use

The set is located within the **Animals : Songbird ReMix** folder. Here is where you will find a number of folders, such as **Bird Library**, **Manuals** and **Resources** . Let's look at what is contained in these folders:

- **Bird Library:** This folder holds the actual species and poses for the "premade" birds. Birds are placed into a "type" folder (such as "Birds of Prey (Order Falconiformes)" which for example would hold falcons, hawks and eagles). The birds for this set can be found in the following folder(s):
  - **Albatrosses and Petrels (Order Procellariiformes)**
  - **Birds of Prey2 (Order Accipitriformes)**
  - **Boobies and Gannets (Order Suliformes)**
  - **Cranes, Coots and Rails (Order Gruiformes)**
  - **Gulls and Waders (Order Charadriiformes)**
  - **Owls (Order Strigiformes)**
  - **Perching Birds (Order Passeriformes)**
  - **Waterfowl (Order Anseriformes)**
- **Manuals:** Contains a link to the online manual for the set.
- **Props:** Contains any props that might be included in the set
- **Resources:** Items in this folder are for creating and customizing your birds
  - **Bird Base Models:** This folder has the blank, untextured model(s) used in this set. These models are primarily for users who wish to experiment with poses or customize their own species of bird. When using physical renderers such as Iray and Superfly, SubD should be turned to at least "3". For DAZ Studios 3Delight renders, the SubD must be turned from the "High Resolution" setting to the

"Base" setting (otherwise some areas will render incorrectly transparent).

Poser Use

Select **Figures** in the **Runtime** Folder and go to the **Animals : Songbird ReMix** folder. Select the bird from the renderer *Firefly or Superfly*) folder you want and simply click it to load. Some birds in the Songbird ReMix series may load with attached parts (*Conformers*) such as tail or crest extensions. Some of these parts have specific morphs. You will need to click on the attached part to access those controls. Associated poses can be found in the same folder- **Bird Library : (Type) : Poses**.

DAZ Studio Use

Go to the **Animals : Songbird ReMix** folder. Select the bird from the renderer (*3Delight or Iray*) folder you want and simply click it to load. Some birds in the Songbird ReMix series may load with attached parts (*Conformers*) such as tail or crest extensions. Some of these parts have specific morphs. You will need to click on the attached part to access those controls. Associated poses can be found in the same folder- **Bird Library : (Type) : Poses**. **Note:** Using the "Apply this Character to the currently selected Figure(s)" option **will not** properly apply the correct scaling to the bird selected. It is better to delete the existing character first and load the one you want to use.

One Folder to Rule Them All

When I reworked the entire Songbird ReMix library starting in 2018, I decided to abandon the way the birds were sorted (by product name) and choose an Ornithological approach. All birds are found in the Bird Library folder and are arranged by type of bird. This approach is hopefully easier for most to find what bird they are looking for. Admittedly, it will take some getting use to for some longtime users, but I've always approached the Songbird ReMix series as a learning tool as well as a graphics tool, so hopefully some knowledge will rub off by seeing how birds are grouped.

Probably the most deceiving subfolder in the **Bird Library** is **"Perching Birds (Order Passeriformes)".** This is folder you probably will end up "favoriting" because this one folder (Passeriformes) **holds more than 50% of all birds.** Perching birds range from cardinals and jays to chickadees, crow and swallows.

Finding the bird you want within the **"Perching Birds (Order Passeriformes)"** folder can be daunting, even for an experienced birder (such as myself), so I've included an online reference tool within this folder that helps to make your search easier. Click the **"Perching Birds Finder"** icon and when loaded, look at the first column and search for

the type of bird you want. For example, I want a “manakin” (a bird common to Central and South America). Scroll down the first column alphabetically and stop on “manakin”. Looking across to the second column, you will now know that manakins can be found in the “Tyrant Flycatchers & their Allies” subfolder.

Physical-based Rendering

Iray and **Superfly** requires more CPU and memory horsepower than the legacy renderers because of ray-trace bounces and higher resolution meshes needed for displacement. Poser’s **Superfly** renderer will require that the “Min Transparent Bounces” be set to **at least 16** and that the “Max Transparent Bounces” be set to **at least 32** in render settings. Superfly renders may show artifacts in the head area. This is a known Poser issue and may be addressed in the future. Increasing the SubD may minimize this issue.

Posing & Shaping Considerations

This volume has various species, so when using generic poses not every pose will work perfectly with every bird. You may find that some minor alteration on the stock poses may be warranted.

Here are some of the most common alterations you may need to make:

- Birds will not be flat on the zero plane due to leg size and overall scale.
- Because of the numerous beak shapes, closing the beak may range from 0.5 to 1. Usually 0.8 is about right.
- **Raise Upper Beak** ***(****in Action Controls****):*** This morph is a “one size fits all” control. Because of the variety of beak shapes. It may not work with all birds.
- **Tongue poke-through** (especially when the beak is open). This can be easily solved by using the **Throat-Fuller1 & 2** morphs (*found in Creation Control/Head Shapes*).

IK Concerns

Some poses may go askew when IK is turned on. By default, Poser’s IK feature is turned off when loading a bird. To turn it on, select the “Figure” category from the main tool bar and “Use Inverse Kinematics” from the submenu.

By default, DAZ Studio’s IK feature is turned on when loading a bird. This will cause the thigh and shin rotations change when the character is moved. The **CTRL K** keypress will turn IK on and off in DAZ Studio. IK doesn’t work that well in Studio, so I suggest selecting the character in the **Scene tab** and simply deleting the two IK body parts to remove IK.

Type Folder	Bird Species
Albatrosses and Petrels (Order Procellariiformes)	ka'upu (Black-footed Albatross)
Birds of Prey2 (Order Accipitriformes)	ʻIo (Hawaiian Hawk)
Boobies and Gannets (Order Suliformes)	'a (Masked Booby) iwa (Great Frigatebird)
Cranes, Coots and Rails (Order Gruiformes)	ʻalae keʻokeʻo (Hawaiian Coot)
Gulls and Waders (Order Charadriiformes)	ʻae'o (Hawaiian Stilt) ʻaʻo (Hawaiian Shearwater) 'ewa 'ewa (Sooty Tern) noi'o (Hawaiian Black Noddy)
Owls (Order Strigiformes)	pueo (short-eared or Hawaiian Owl)
Perching Birds (Order Passeriformes) Birds of Paradise & their Allies	ʻelepai'o (all species)
Perching Birds (Order Passeriformes) Crows, Jays and their Allies	ʻalala (Hawaiian Crow)
Perching Birds (Order Passeriformes) Hawaiian Honeycreeper Finches	ʻākepa (ʻākepa) 'akiapola'au ('Akiapola'au) ʻakikiki (Kaua'i Creeper) 'akohekohe (Crested Honeycreeper) ʻalauahio (O'ahu Creeper) ʻamakihi (ʻAmakihi) 'apapane ('Apapane) ʻi'iwi (ʻI'iwi) kakawahie (Moloka'i Creeper) kiwikiu (Maui Parrotbill) mamo (Hawai'i Mamo) nukupu'u (all three species) ʻŌʻō (Honeyeaters) o'o nuku'umu (Black Mamo) palila (Palia) po'o-uli (Black masked Creeper)

Type Folder	Bird Species
Perching Birds (Order Passeriformes) Old Warblers & their Allies	Millerbirds (both species)
Perching Birds (Order Passeriformes) Thrushes, Oxpeckers & their Allies	kāmaʻo (Large Kauaʻi Thrush) oloma'o (Lana'i Thrush) oma'o (Hawaiian Thrush)
Waterfowl (Order Anseriformes)	Koloa Maoli (Hawaiian Duck) nēnē (Hawaiian Goose)

Volcano National Park (Photo: Ken Gilliland)

Endemic Birds of Hawai'i
Field Guide

Albatrosses
ka'upu (Black-footed Albatross)

Petrels and Shearwaters
ʻaʻo (Hawaiian Shearwater)

Pelecaniformes
'a (Masked Booby)
iwa (Great Frigatebird)

Ducks and Geese
Koloa Maoli (Hawaiian Duck)
nēnē (Hawaiian Goose)

Gulls, Terns & Skimmers
'ewa 'ewa (Sooty Tern)

Shorebirds
ao'e (Hawaiian Silt)
noi'o (Hawaiian Black Noddy)

Owls
pueo (Hawaiian Owl)

Honeyeaters
Oʻahu ʻŌʻō (Oʻahu Honeyeater)

Warblers & Elepaio
ʻelepai'o (Hawaiian Wren)

Millerbirds
Nihoa Millerbird

Thrushes
oma'o (Hawaiian Thrush)
kāmaʻo (Large Kauaʻi Thrush)
oloma'o (Lana'i Thrush)

Crows
ʻalala (Hawaiian Crow)

Drepanidine Finches
palila (Palia)

Honeycreepers
ʻākepa (ʻākepa)
ʻamakihi (Amakihi)
'akiapola'au ('Akiapola'au)
nukupu'u (Nukupu'u)
ʻakikiki (Kaua'i Creeper)
kiwikiu (Maui Parrotbill)
'apapane ('Apapane)
ʻI'iwi (ʻI'iwi)
'akohekohe (Crested Honeycreeper)
po'o-uli (Black masked Creeper)
Oʻahu ʻalauahio (O'ahu Creeper)
kakawahie (Moloka'i Creeper)
Hawai'i mamo (Hawai'i Mamo)
o'o nuku'umu (Black Mamo)

Birds and Hawai'i

One-third of the birds found on the United States Endangered Species are found in Hawaii. Over thirty Hawaiian bird species are listed as endangered, more than anywhere else in the country. "That is the epicenter of extinctions and near-extinctions," said John Fitzpatrick, director of the Cornell Lab of Ornithology, which helped produce the study. "Hawaii is a borderline ecological disaster."

Hawaii's native birds are threatened by the destruction of their habitats by invasive plant species and feral animals like pigs, goats and sheep. Diseases, especially those borne by mosquitoes, are another killer. Because mosquitoes were introduced to the Hawaiian Islands by man, the endemic birds have no natural resistance to avian malaria. Most of the endemic birds are only found now in high elevation areas where mosquitoes can't survive.

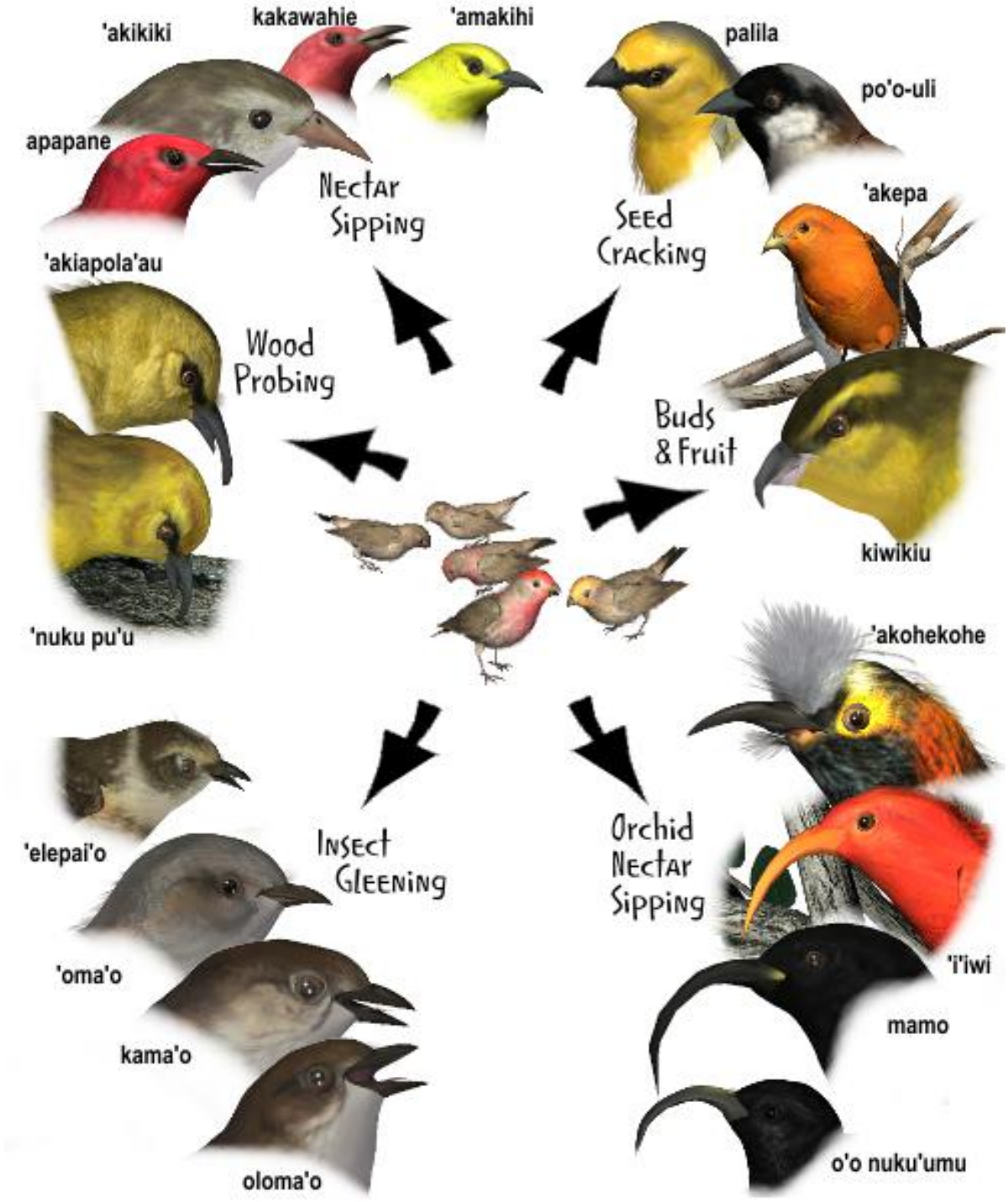
Mist rolls in at Hakalau Forest National Wildlife Refuge (Photo: Ken Gilliland)

While many species are moving to the extinction column, there is one Hawaiian success story. A habitat restoration project on the big island appears to be working. At the Hakalau Forest National Wildlife Refuge, workers installed fences, controlled invasive plant species, removed pigs, and planted koa and ohia trees (trees crucial to many endemic birds nesting and foraging). In 2009, Hakalau's populations of the Hawaii creeper and akiapolaau had increased dramatically.

Scott Fretz, wildlife program manager at the state's Division of Forestry and Wildlife, said he was confident such efforts could help restore all of Hawaii's endangered bird species, excluding those that have already become extinct.

"The basic, fundamental problem that we have is a lack of funding to do what we need to do," Fretz said. "If we had a lot more funding than we do, we would be able to recover most, if not all, of the species that we have that are endangered."

Fretz said the key is to get the US Congress to approve funding, which they been reluctant to do so far. Funding is the key to continue restoration efforts in Hawaii and to help it cope with climate change. Climate change is a serious issue in Hawaii because warmer temperatures allow mosquitoes to enter habitats at higher elevations currently inhabited by the endemic Hawaiian birds….



EVOLUTION of the FINCH

A number of Hawaiian Birds evolved from a single species of finch; each becoming a specialist at a specific food source.

Hawaiian Name: ka'upu
Common Name: Black-footed Albatross
Scientific Name: *Phoebastria nigripes*

Size: 25-29 inches (64–74 cm)

Habitat: Northern Pacific Hemisphere. They nest in colonies on isolated islands of the Northwestern Hawaiian Islands (Laysan and Midway), and the Japanese islands of Tori Shima, Bonin, and Senkaku. Found from Alaska to California and Japan

Status: Near Threatened. **Global Population:** 278,000 mature individuals with a stable to increasing population trend. It is taken incidentally by long-line fishing. An estimated 4,500 are taken every year. It is also vulnerable to oil and ingestion of floating plastics, which reduces the space in the stomach available for food to be brought to the chick. All of its nesting sites in the U.S. are protected.

Diet: Fish, flying fish eggs, squid and to a lesser extent crustaceans.

Nesting: An entirely dusky brown except for narrow whitish ring around base of bill and another under the eye. Sexes and age classes similar, although younger adults tend to have less white

on rump and under tail coverts and around the base of the bill. Males also are slightly larger than females, with larger bill.

Albatrosses form long term pair-bonds that last for life. After fledging the birds return to the colony after three years, and spend two years building nests, dancing and being with prospective mates, a behavior that probably evolved to ensure maximum trust between the birds (raising an albatross chick is a massive energetic investment, and a long courting period establishes for both birds that the other is committed).

Nests are simple depressions scraped in the sand, into which one egg is laid. The egg is incubated for just over two months (65 days). Both birds incubate the egg, the male incubating more as the female leaves soon after hatching to recoup reserves used for egg-laying. The average time spent on incubating shifts is 18 days. However, mates can wait up to 38 days to be relieved, and if something happens to the mate the other has been recorded incubating for 49 days without food or water.

The chick is brooded for 20 days by its parents, after which both parents leave the nest and return to feed the chick. The chick is fed regurgitated food by sticking its bill inside that of its parent. Fledging occurs after 140 days.

Cool Facts: The Black-footed Albatross is one of three Albatrosses found in the northern Hemisphere and is the only dark colored one. It has a keen sense of smell, which it uses to locate food across vast expanses of ocean. It will scare other predators away from its food by spreading its wings and screaming at it. It drinks seawater and excretes excess salt through glands above the eyes.

The Black-footed Albatross has a number of apparent adaptations to stay cool at hot, exposed nest sites. These include an extensive network of blood vessels in the head, as well as a habit of raising the feet off the ground.

Hawaiian name Ka'upu describes the bird's call.

Kona Coast, Hawai'i (Photo: Ken Gilliland)

Hawaiian Name: ʻaʻo

Common Name: Hawaiian or Newell's Shearwater

Scientific Name: *Puffinus newelli*

Size: 13 inches (33 cm); 76 cm wingspan

Habitat: Oceania; It breeds in at least 20 colonies on mountain slopes in the Hawaiian Islands. The main colonies are on Kauaʻi, on slopes around the Alakaʻi Plateau and probably in the Mokolea Mountains. Its distribution on the other islands is uncertain but it is known to breed on Molokaʻi and the island of Hawaiʻi and may breed on Oʻahu, Mau'i and Lānaʻi. From April to November it can be seen in the waters around the Hawaiian Islands, particularly around Kauaʻi. Outside the breeding season it disperses into the tropical Pacific Ocean. Its distribution at sea is little known but many move south and east into the waters of the Equatorial Counter Current. It has been recorded as far west as the Mariana Islands. In the south there are recorded sightings from Samoa in September 1977 and American Samoa in January 1993.

Status: **Critically Endangered.** **Global Population:** 10,000-19,999 mature individuals and rapidly decreasing. Since 2011, the population of this species has plummeted by over 60%.

The main threat to this species is thought to be predation by non-native species. Predation of adults and juveniles by feral cats and Barn Owls has been documented on almost every colony on Kaua'i, including the most remote sites. Polynesian Rats, Black Rats, Brown Rats and House Mice were inadvertently introduced to the Hawaiian islands as a result of human activity and shipwrecks and may depredate eggs and chicks. Brown Rats appear to be more associated with human settlement and do not appear to be as severe a threat as the other two introduced rat species. Another potential predator, the Small Indian Mongoose, has recently been discovered on Kaua'i, and could potentially be a greater threat than cats as its smaller size means it may be able to enter breeding burrows more easily. It is yet to establish a permanent presence on the island, although it has a history of incursions onto Kaua'i and one was trapped there in 2016. When the Two-spotted Leafhopper first established on the Hawaiian Islands, it led to habitat loss through feeding on the Uluhe Fern which provide cover for shearwater

burrows. The leafhopper was a cause for great concern not only for shearwaters, but also for agricultural crops and native flora; hence a biological control program was initiated and the insect is now hard to find on Hawai'i. Dogs have been shot at Ka'ena Point, while attacking nestling albatrosses and shearwaters, but the scale of their impact is unknown. Habitat loss due to conversion and introduction of herbivores like domesticated goats and pigs pose another threat on the Hawaiian Islands, and have been suggested as a contributing factor for the recent abandonment of some colonies.

On Kaua'i, hurricanes Iwa and Iniki devastated the forests in 1982 and 1992, dramatically reducing available nesting habitat and reducing breeding attempts for Newell's Shearwaters. Given that a large proportion of the population breeds on Kaua'i, catastrophic events, like hurricanes, represent a serious threat.

During the 1980s and 1990s an estimated 70 adults and 280 sub-adults each summer, and at least 340 fledglings each autumn, died as a result of collisions with power-lines and communications towers, or indirectly because of light attraction. In the surveyed areas on eastern and southern Kaua'i, 350 adults are reported dead each year from collisions with power lines. Fledglings on their first flight to the ocean are particularly susceptible to attraction to artificial light. The birds are attracted and disoriented by coastal street lights and once grounded, unable to fly and often killed by cars, cats or dogs, or die from starvation or dehydration. Between 1978 and 1981, more than 5,000 individuals were grounded on Kaua'i, and more than 30,000 have been found as victims of fallout since 1971. Intense rescue programm have been initiated to find grounded birds and return them to the sea. On Kaua'i, approximately 1,500 fledglings are recovered annually after becoming grounded, although with the suspected steep population decline on Kaua'i, the number of grounded birds is expected to have decreased proportionately. Collision with artificial structures (such as powerlines and wind turbines) is another key threat to the species, particularly in flight corridors for subadult and adult birds accessing inland colonies. Nine communications towers have recently been constructed on the Hawaiian Islands without proper consultation, and these are now the subject of an ongoing lawsuit. A field of wind generators was planned for Kaua'i and Lana'i, without accounting for the potential impacts on this species. Although wind farms have been shown to have only minor effects on other bird species elsewhere, night-flying Shearwaters may be particularly vulnerable and the cumulative effects of construction and maintenance, erosion, vegetation clearing and noise should be accounted for. It is not confirmed whether the wind farm projects will be realized.

Plastic pollution poses yet another threat. On Kaua'i, 50% of Newell's Shearwater fledglings necropsied during 2007–2014 contained plastic items in their digestive tract and there is evidence that the mass and the number of items ingested per bird have also increased since the 1980s. It is thought that consumption of even small quantities of plastic, including fibers and small fragments, exposes birds at all stages of the breeding cycle to plastic-associated co-pollutants and associated impacts survival.

On Hawai'i, cinder mining has resulted in habitat loss at several colonies and together with other causes of habitat degradation (invasive vegetation, agriculture and urbanization) contributes to the exposure and increased predation of ground-nesting birds. The species is also likely to be impacted by the commercial fishery through bycatch and indirect ecosystem effects resulting from overfishing of tuna.

Diet: Squid and small fish. It feeds far from land, in areas of deep water (at least 2000 meters). It dives into the water to catch its prey, swimming down to a depth of up to 10 meters using its wings to move forward. It is attracted to schools of tuna and gathers in flocks with other seabird species to catch prey driven to the surface by the tuna.

Breeding: The upper parts are black with a brown tinge while the under parts are white. The dark coloration on the face extends below the eye and is sharply separated from the white throat. There is a white patch on the flanks, extending onto the sides of the rump. The under wings are mainly white with a dark border. The under tail-coverts have a black and white pattern and appear white in the field. The bill is dark gray or brown and the legs and feet are mainly pale pink.

The nest site is a burrow dug into a steep slope, usually sheltered by uluhe (*Dicranopteris linearis* ferns). A single white egg is laid during the first two weeks of June. Both parents incubate the egg and an incubation period of 62 days has been recorded. The young birds leave the nest in October, 88-100 days after hatching. They fly out to sea and are no longer dependent on their parents.

Cool Facts: It is named after Brother Matthias Newell, a missionary who worked in Hawaii from 1886 to 1924. By 1908, it was thought to be extinct but was rediscovered in 1947 and found breeding on Kaua‘i in 1967. It is known in Hawaiian as the ‘a‘o which describes its’ call.

The bird flies low over the water on stiff wings with a mixture of short glides and periods of rapid flapping.

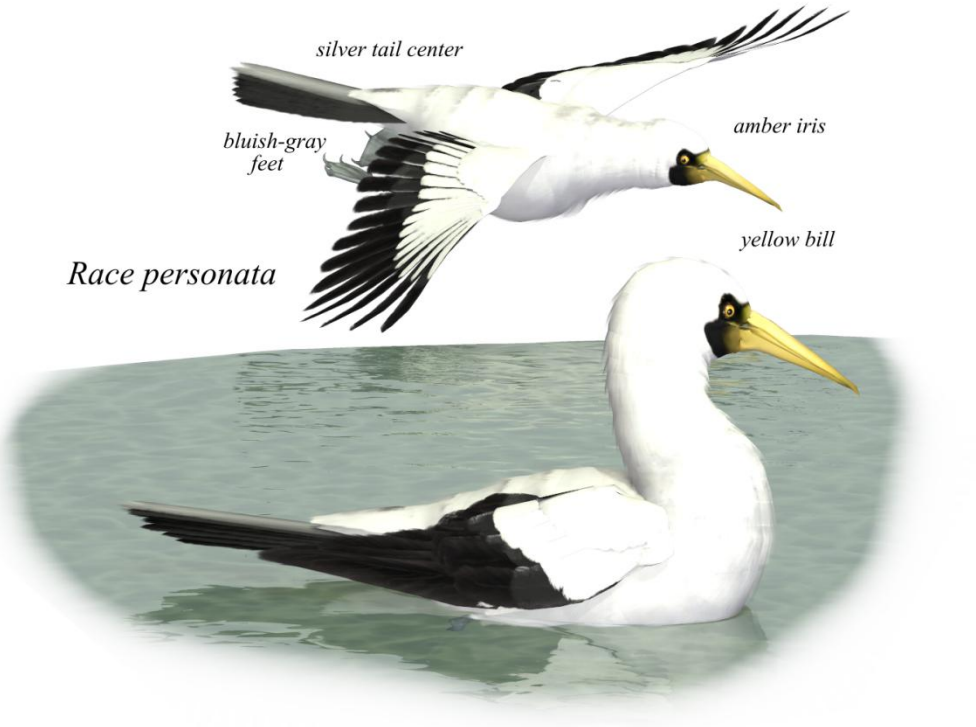
Hawaiian Name: ʻa
Common Name: Masked Booby
Scientific Name: *Sula dactylatra personata*

Size: 29-34 inches (74-86 cm)

Habitat: Tropical Oceans; from the Caribbean, across the Pacific Ocean, to Hawaii, Australia, and Indonesia-- a rare visitor to the United States.

For roosting and breeding , it exclusively favors smaller oceanic islands (especially flat, unforested terrain) within 30° of the Equator. Breeding colonies are found on coral sand beach (Latham, west Indian Ocean); on pampa-like vegetation consisting of *Eragrostis variabilis, Boerhavia diffusa, Lepidium owaihiense, Tribulus cistoides, Ipomea indica, Solanum nelsoni,* and *Verbesina encelioides* (Kure, Hawaiian Islands.). It typically avoids nesting directly on vegetation or on steep slopes or cliffs, but favors locations near cliff edges or on high spots that facilitate taking flight.

Status: Not threatened. **Global Population:** 211,000,000 mature adults with a declining population. At least some mortality from tangling in fishing gear, but this problem is not known to be significant. It probably has frequent interactions with purse-seining tuna fisheries, as the fisheries often use Masked Boobies and other seabirds to locate tuna schools, but no scientific data exists.



Diet: Fish and squid.

It forages in blue-water pelagic zones. It plunge-dives from various heights up to 30 m (100 feet) into schools of fish.

Nesting: Sexes are similar in appearance but females are slightly larger. The adult plumage is bright white, except for the black to blackish-brown primaries, secondaries, humerals, and tail. The white on the wings is restricted to the marginal, lesser and median coverts, and some of the outer primary-coverts (the rest are blackish-brown to black). The under wing has white coverts, remiges blackish distally and broadly tinged pale gray on bases. The bill ranges from a greenish-yellow to bright yellow and is thick-based, tapering down without much curvature. The dark slate to black skin around the eye, extending narrowly to the upper bill and on the lores to the upper throat. It is less dark on the chin and lores.

The juvenile plumage is a dark chocolate to black except for the white upper back which forms a broad conspicuous collar and white breast. The tips of the scapulars have a whitish dull brown color, with less distinct pale tips to the lesser coverts and on back to the upper tail-coverts. It rear flanks and rear thighs are a blotchy dark brown, otherwise it has all-white under parts and under wing-coverts white with a dark carpal patch and narrow dark line towards base of wing. As the birds age, the upper parts (including the marginal and lesser wing-coverts) acquire dark brown and white feathers in that form a checkerboard-like pattern.

Nests are a slight depression on ground, surrounded by circle of pebbles or other debris, often near a breezy cliff edge or other take-off feature. One to two light blue eggs are laid. Although the Masked Booby regularly lays two eggs, it never raises two young. The first egg is laid four to nine days before the second, and the older chick always ejects the second from the nest. The parents do not protect or feed the ejected chick, and it is quickly scavenged by a host of associated crabs, landbirds, and frigatebirds.

Cool Facts: The Masked Booby, also known as the White or Blue-faced Booby.

The population of boobies breeding along the Pacific Coast of northern South America, including the Galapagos, was recently recognized as a separate species, the Nazca Booby (*Sula granti*). Until 2000, it had been considered a Masked Booby subspecies. The Nazca Booby has an orange, not yellow, bill and is smaller with a significantly shorter, shallower bill. Whereas the Masked Booby usually nests on low, flat areas, the Nazca Booby uses cliffs and steep slopes.

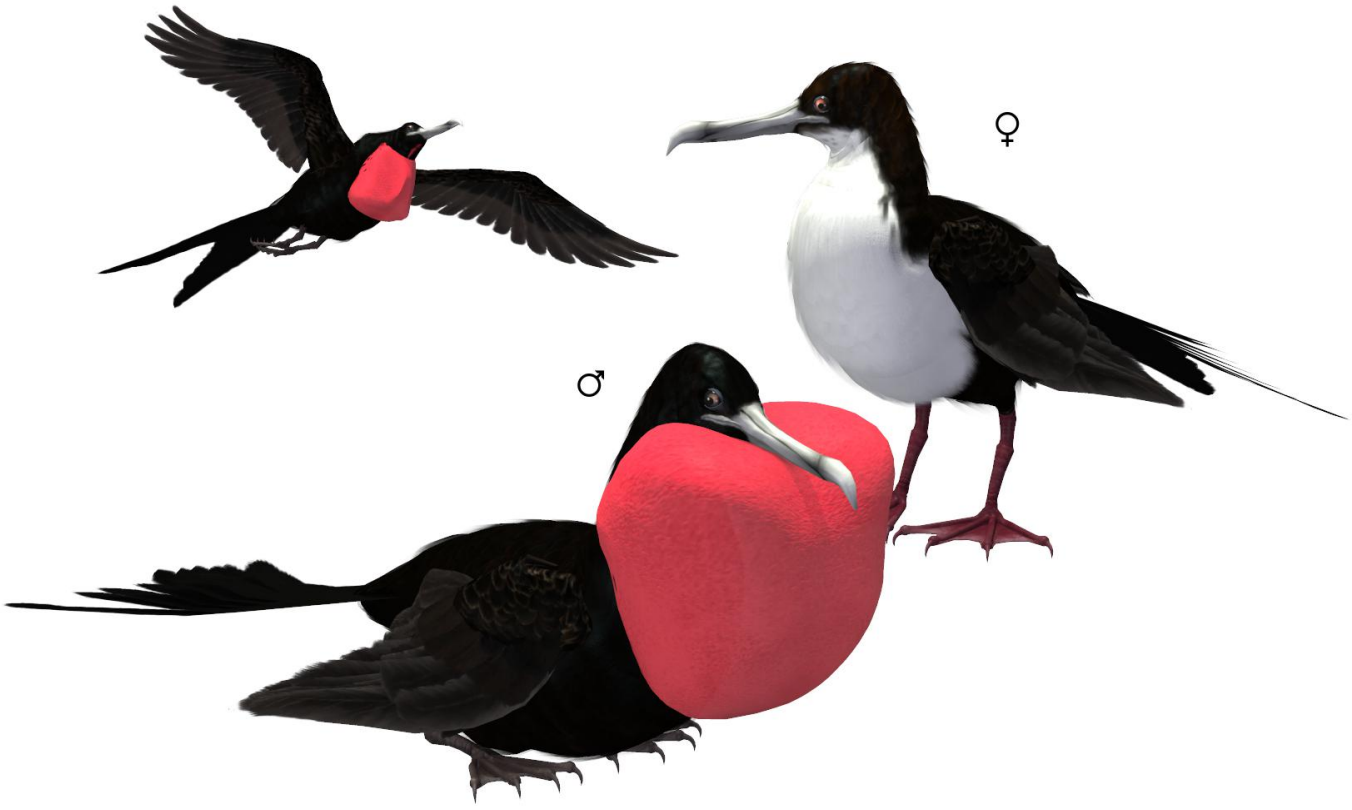
Four subspecies are recognized:

- *S. d. personata.* This subspecies breeds in the southeastern Indian Ocean (Cocos Keeling Islands, Christmas Island and northwestern Australia), and on numerous islands in the west and central Pacific Ocean from Philippines eastward through Micronesia and Polynesia, north to the Hawaiian Islands and south to the Coral Sea, off northeastern Australia. It is also found in the eastern Pacific on islands off western Mexico (Alijos Rocks, Clarión Island, San Benedicto, Clipperton Island) and off north-central Chile (San Félix, San Ambrosio). It has a yellow bill and its iris tends to be orange-yellow or amber. Its legs and feet are olive drab to bluish-gray.
- *S. d. tasmani.* This subspecies breeds in the northern Tasman Sea (Lord Howe Island, Norfolk Island and Kermadec Islands). Its iris is brown (all other subspecies have yellow iris). Its bill is straw-yellow to olivaceous greenish-yellow and its legs are a dark khaki-gray. It is grayer on the tarsi.
- *S. d. dactylatra*. The nominate subspecies breeds on islands in the Caribbean and off the northern coast of South America (South to eastern Brazil), on Ascension Island (Southern Atlantic Ocean), and possibly also still in the Bahamas. Its defining characteristics are its straw-colored bill, orange to olive legs and feet.
- *S. d. melanops.* This subspecies breeds on islands of southern Red Sea and western Indian Ocean. Its bill is orange-yellow to yellow-green. Its legs and feet are lead gray to khaki-olive. Its tarsi is often grayer, and the central tail feathers are with little or no silvery gray.

Hawaiian Name: iwa
Common Name: Great Frigatebird
Scientific Name: Fregata minor

Size: 33-41 inches (85-105 cm); 205–230 cm Wingspan

Habitat: Tropical Oceans; Hawaii is the northernmost extent of their range in the Pacific Ocean, with around 10,000 pairs nesting mostly in the Northwestern Hawaiian Islands. In the Central and South Pacific, colonies are found on most islands Groups from Wake Island to the Galapagos Islands to New Caledonia with a few pairs nesting on Australian possessions in the Coral Sea. Colonies are also found on numerous Indian Ocean islands including Aldabra, Christmas Island, Maldives and Mauritius. The small populations in the Western Atlantic Ocean may still persist but are very small if they do. Great Frigatebirds undertake regular migrations across their range, both regular trips and more infrequent widespread dispersals. Birds marked with wing tags on Tern Island in French Frigate Shoals were found to regularly travel to



Johnston Atoll (873 km), one was reported in Quezon City in the Philippines. Despite their far ranging birds also exhibit philopatry, breeding in their natal colony even if they travel to other colonies.

The Great Frigatebird forages in pelagic waters within 80 km (50 mi) of the breeding colony or roosting areas.

Status: Least Concern. **Global Population:** 340,000 - 1,000,000 mature individuals. The population is suspected to be in decline owing to ongoing habitat destruction and unsustainable levels of exploitation.

Diet: Flying fish, other fish species and squid. Prey is snatched while in flight, either from just below the surface or from the air in the case of flying fish flushed from the water.

Nesting: Male Great Frigatebirds are smaller than females, but the extent of the variation varies geographically. The plumage of males is black with scapular feathers that have a purple-green iridescence when they refract sunlight. Females are black with a white throat and breast and have a red eye ring. Juveniles are black with a rust-tinged white face, head and throat.

Great Frigatebirds are seasonally monogamous, with a breeding season that can take two years from mating to the end of parental care. The species is colonial, nesting in bushes and trees (and on the ground in the absence of vegetation) in colonies of up to several thousand pairs. Nesting bushes are often shared with other species, especially Red-footed Boobies and other species of frigatebirds.

Both sexes have a patch of red skin at the throat that is the gular sac; in male Great Frigatebirds this is inflated in order to attract a mate. Groups of males sit in bushes and trees and force air into their sac, causing it to inflate over a period of 20 minutes into a startling red balloon. As females fly overhead the males waggle their heads from side to side, shake their wings and call. Females will observe many groups of males before forming a pair bond. After forming a bond the pair will choose a nesting site, which may be at the display site or another location; once a nesting site has been established both sexes will defend their territory (the area surrounding the nest that they are able to reach) from other frigatebirds.

Pair bond formation and nest-building can be completed in a couple of days by some pairs and can take a couple of weeks (up to four) for other pairs. Males collect loose nesting material (twigs, vines, flotsam) from around the colony and off the ocean surface and return to the nesting site where the female builds the nest. Nesting material may be stolen from other seabird species (in the case of Black Noddies the entire nest may be stolen) either snatched off the nesting site or stolen from other birds themselves foraging for nesting material. Great Frigatebird nests are large platforms of loosely woven twigs that quickly become encrusted with guano. There is little attempt to maintain the nests during the breeding season and nests may disintegrate before the end of the season.

A single dull chalky-white egg measuring 68 x 48 mm is laid during each breeding season. If the egg is lost the pair bond breaks; females may acquire a new mate and lay again in that year. Both parents incubate the egg in shifts that last between 3–6 days; the length of shift varies by location, although female shifts are longer than those of males. Incubation can be energetically demanding, birds have been recorded losing between 20–33% of their body mass during a shift.

Incubation lasts for around 55 days. Great Frigatebird chicks begin calling a few days before hatching and rub their egg tooth against the shell. The altricial chicks are naked and helpless, and lie prone for several days after hatching. Chicks are brooded for two weeks after hatching, during this time they become covered in white down. Then they are guarded by a parent for another fortnight. Chicks are given numerous meals a day after hatching, once older they are fed every one to two days. Feeding is by regurgitation, the chick sticks its head inside the adult's mouth.

Fledging occurs after 4–6 months, the timing dependent on oceanic conditions and food availability. In bad years (particularly El Niño years) the period of care is longer. After fledging chicks continue to receive parental care for between 150–428 days; frigatebirds have the longest period of post-fledging parental care of any bird. The diet of these juvenile birds is provided in part by food they obtained for themselves and in part from their parents. Young fledglings will also engage in play; with one bird picking up a stick and being chased by one or more other fledglings. After the chick drops the stick the chaser attempts to catch the stick before it hits the water, after which the game starts again. This play is thought to be important in developing the aerial skills needed to fish.

Cool Facts: The Great Frigatebird is a large seabird and, despite its name, it is the second largest frigatebird, after the Magnificent Frigatebird. The frigatebirds have the highest ratio of wing area to body mass, and the lowest wing loading of any bird. It has been hypothesized that this enables the birds to utilize marine thermals created by small differences between tropical air and water temperatures.

The Hawaiian name, iwa, means “thief”. While frigatebirds are known for stealing food from other birds, they do catch the majority of their meals without stealing them.

Sea turtle on black sand beach, Hawai’i (Photo: Ken Gilliland)

Hawaiian Name: koloa maoli

Common Name: Koloa Maoli (Hawaiian Duck)

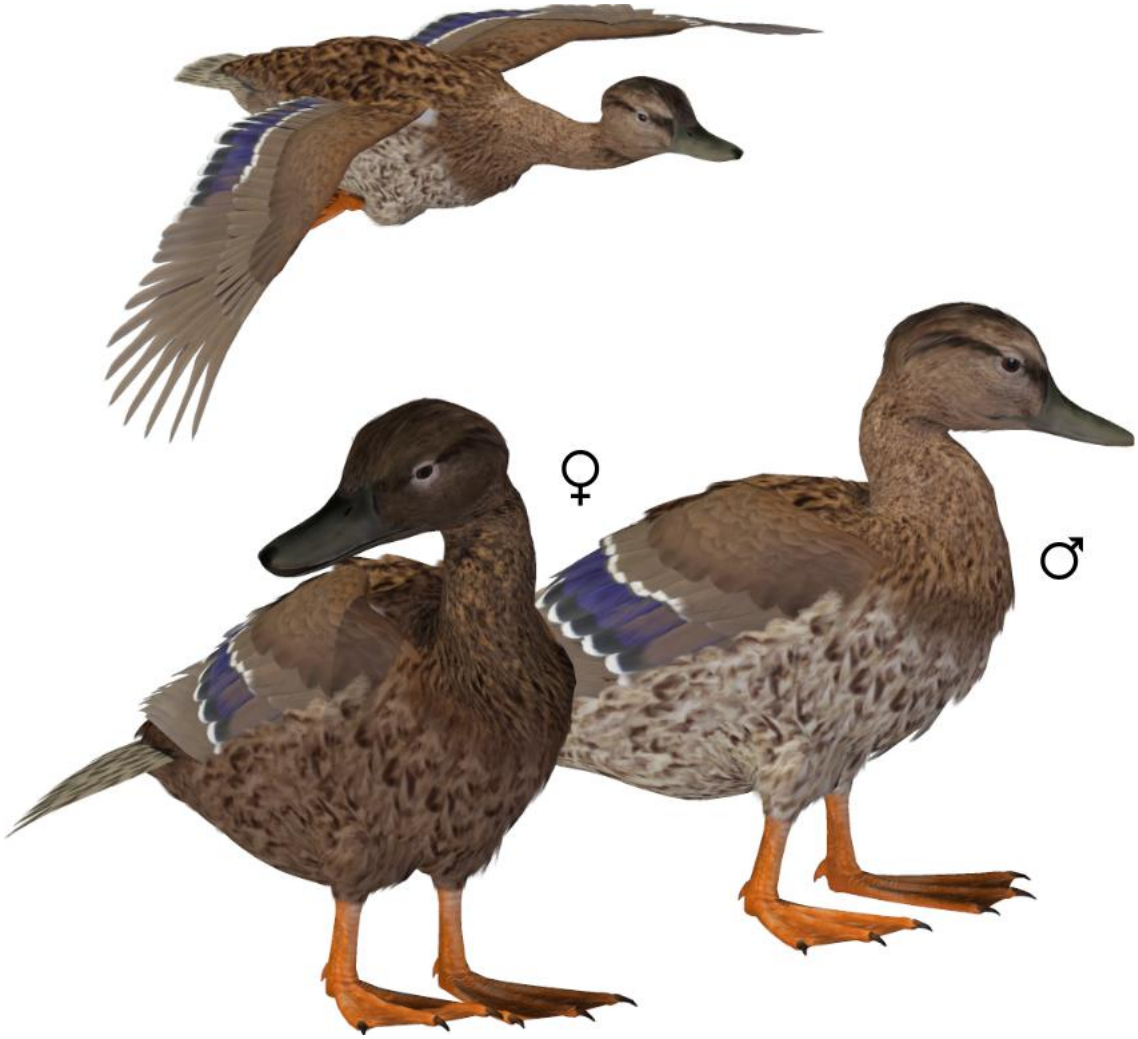
Scientific Name: *Anas wyvilliana*

Size: 25 inches (64 cm)

Habitat: Oceania; the “pure-bred” species is restricted to Kauaʻi, with some seasonal movement to ephemeral wetlands on the island of Niʻihau. The species has been successfully re-established, through captive propagation and release, in the mid-elevations of the Köhala Mtns. and wetter slopes of Mauna Kea, on the island of Hawaiʻi. Historically, this species historically inhabited the main Hawaiian Islands, except the dry islands of Kahoʻolawe and Länaʻi.

On these islands, found in coastal wetlands, rivers, stream-plunge pools, and ponds to an elevation of 3,000 m.

Status: **Endangered.** **Global Population:** 2,000. In the mid-1800s, it was considered “common” and was hunted for sport. By 1900, and again in the early 1920s, however, several ornithologists began to note the species' decline, and it was extirpated from all islands but Oʻahu, Kauaʻi, and Niʻihau by the 1950s. By 1962, it was restricted to the latter 2 islands, and



population estimates at that time indicated fewer than 500 individuals.

The decline of the Hawaiian Duck is directly related to the destruction of key wetland habitats in the Hawaiian Islands, particularly Waikīkī, Kaʻelepulu, Köloa Swamp, and Kawai nui marshes on Oʻahu and the Mana wetlands on Kauaʻi.

On Hawaiʻi, Mau'i, and Molokaʻi, this species was never abundant in historic times, owing to limited habitat. In addition to habitat loss, predation from introduced mammals dealt a severe blow to the species. Sport hunting continued well into the first third of the twentieth century and has been mentioned as a factor in the species' decline.

In addition, the Hawaiian Duck is confronted with the modern threat of hybridization with feral Mallards (*Anas platyrhynchos*), the single most important threat facing its continued existence. Hybrid swarms now exist on Oʻahu and Mau'i, and hybrid birds have recently been documented from Hawaiʻi and Kauaʻi.

By 2000, populations of genetically pure Hawaiian Duck existed only on Kauaʻi and the upper elevations of Hawaiʻi Island (the latter a result of reintroduction through captive propagation and release). It has been re-established on the islands of Oʻahu and Mau'i through captive propagation and release programs, but populations now almost entirely comprise hybrids with introduced Mallard.

Diet: Aquatic invertebrates, aquatic plants, seeds, grains, and some tadpoles.

Like other dabbling dusks, it forages by filtering seeds and invertebrates from water column through lamellae of the bill, or tipping and foraging in subsurface mud layers. It strips seeds from grasses and other emergent plants as other Anas ducks do, and grazes in moist areas on grasses.

Breeding: A medium-sized duck. Adult males are dark brown, variably spotted and mottled, with distinctive darker-brown chevrons on breast, flank, and back feathers, dark speckled chin, and olive bill. Some males also have greenish tints around eyes and auricular regions, and in some, the central pair of rectrices are blackish and recurved, but these head and tail markings not present in all males. Adult female similar but averages slightly smaller than male (sexes overlap in all measurements, however), and slightly lighter in color, with plainer, buff-colored chin (dark markings on chin-feathers much finer and less noticeable than in males), plainer back feathers (lack dark chevron markings present in males), and pale olive with pinkish tip and cutting edge. Most females also exhibit a buff supercilium and contrasting dark eye-line, and some also have a distinctive buff lore-spot. For additional sexual differences, see Appearance, below. In both sexes, legs and feet orange to yellow-orange, under wing-lining white, and pale eye-crescents may be present (or, in some females, a pale patch surrounds eye). Pattern on upperwing surface varies. Some males exhibit gray-brown scapulars and tertials; some are mottled brown (Basic vs. Alternate plumage?). Females exhibit mottled scapulars and tertials. In males, the speculum is emerald green to blue (lighting in field may enhance blue tones), bordered anteriorly by black and faint white bars, and distally by black and bold white bars. In female, speculum similar but duller, without anterior black border and with buff trailing edge. In immature (Alternate I) male, breast has vinaceous pink overtones with U-shaped dark barring; some birds have solid-gray tertials and wing coverts. Under tail-coverts and rump black with brown mottling, tail pale gray. Much green in otherwise mottled head. Birds in this plumage exhibit strongly curled, black central tail feathers.

Females quack when flushed, presumably as an alarm to other birds in the area. Males generally silent outside of breeding season. Female also quietly quacks to young to keep brood together. Males and females quack (latter more rapidly) and chortle during nuptial flights and pair-bonding courtship rituals. Pairs usually form fall and winter, but can form at any time of year depending on rainfall and habitat availability. Pair bond breaks soon after female begins incubation. The male does not aid in incubation or rearing of young. The nest is constructed by the female only and is similar to that for a Mallard; a shallow bowl, lined with grasses and a little down. A clutch of 2 to 10 eggs is laid. The incubation period is about 28 days and fledge after about 65 days.

Cool Facts: A close relative of the Mallard (*Anas platyrhynchos*) endangered Hawaiian Duck is 1 of only 3 endemic species of waterfowl in the Hawaiian Islands today. On Kaua'i, Hawaiian Duck co-exists with 4 other federally endangered waterbirds: Hawaiian Goose, Hawaiian Coot, Hawaiian Moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian Stilt. On island of Hawai'i, range overlaps Hawaiian Goose, rarely Hawaiian Coot, Hawaiian Hawk, and Hawaiian hoary bat (*Lasiurus cinereus semotus*). On both islands, in montane regions, its range overlaps many native forest bird species and plant communities.

Kihikihi (Moorish Idol). Hawaii has over 600 fish species. **(Photo: Ken Gilliland)**

Hawaiian Name: nēnē
Common Name: Nēnē or Hawaiian Goose
Scientific Name: *Branta sandvicensis*

Size: 25 inches (64 cm)

Habitat: Oceania; restricted to Hawai‘i, Mau'i, Moloka‘i, and Kaua‘i. Historically, it was also found on Kaho‘olawe and Lāna‘i.

The Nēnē is an inhabitant of shrubland, grassland, coastal dunes, lava plains, and related anthropogenic habitats such as pasture and golf courses from sea level to as much as 2,400 m. Some populations migrated between lowland breeding grounds and montane foraging areas.

Status: Vulnerable.
Global Population: 2,500. It is believed that it once was common, with approximately 25,000 Hawaiian Geese living in Hawai‘i when Captain James Cook arrived in 1778. However, hunting and introduced predators, such as Small Asian Mongooses, pigs, and cats, reduced the population to 30 birds by 1952.

Other threats include disease and parasites, inbreeding depression, loss of adaptive skills in captive-bred birds and dietary deficiencies. Feral cats carry a protozoan organism (*Toxoplasma gondii*) which causes toxoplasmosis, a disease that can be fatal in the species. Road-kills are an important threat on Hawai`i and probably on Mau'i. Indeed road-kills were found to be the most common cause of known adult mortality on Hawai`i from 1989 to 1999.

While breeding in captivity has been successful, recruitment in the wild is low in this species. Yearly average hatching success was only 55% (range 44-77%), probably because of introduced predators rather than inbreeding. A yearly average of only 30% (range 0-50%) of

nestlings fledged, with most lost to starvation, dehydration and predation. Recruitment into the breeding population is low, with only 42% of tracked fledglings eventually attempting to breed. An average of 35% of the population breed each year, probably limited by food availability, which affects the females condition.

Diet: Herbivorous; leaves, seeds, fruit, flowers of grasses and shrubs.

Breeding: The male and female of the species look similar with the exception that males are 10% larger.

The breeding season of the Nēnē, from August to April, is longer than that of any other goose; most eggs are laid between November and January. Unlike most other waterfowl, the Nēnē mates on land. Nests are built by females on a site of their choosing, in which one to five eggs are laid (average is three on Mau'i and Hawai‘i, four on Kaua‘i). Females incubate the eggs for 29 to 32 days, while the male acts as a sentry. Goslings are precocial, able to feed on their own; they remain with their parents until the following breeding season.

Cool Facts: The Nēnē evolved from the Canada Goose (*Branta canadensis*), which most likely migrated to the Hawaiian islands 500,000 years ago, shortly after the island of Hawai‘i was formed. This ancestor is the progenitor of the Nēnē as is the prehistoric Giant Hawai‘i Goose and Nēnē-nui (Branta hylobadistes). The Nēnē-nui was larger than the Nēnē, varied from flightless to flighted depending on the individual, and inhabited the island of Mau'i. Similar fossil geese found on O‘ahu and Kaua‘i may be of the same species. The Giant Hawai‘i Goose was restricted to the island of Hawai‘i and measured 1.2 m in length with a mass of 8.6 kg, making it more than four times larger than the Nēnē. It is believed that the herbivorous Giant Hawai‘i Goose occupied the same ecological niche as the goose-like ducks known as moa-nalo, which were not present on the Big Island. Based on mitochondrial DNA found in fossils, all Hawaiian geese, living and dead, are closely related to the Giant Canada Goose (*B. c. maxima*) and Dusky Canada Goose (*B. c. occidentalis*).

Nēnē’s strong toes are padded and have reduced webbing, an adaptation that allows it to swiftly traverse rough terrain such as lava plains.

The Hawaiian name, Nēnē refers to the birds’ call.

Nēnē at Volcano National Park, Hawai’i (Photo: Ken Gilliland)

Hawaiian Name: ‘ewa ‘ewa
Common Name: Sooty Tern
Scientific Name: *Onychoprion fuscatus*

Size: 14-17.5 inches (36-45 cm)

Habitat: Pacific & Indian Oceans. This bird is migratory and dispersive, wintering more widely through the tropical oceans. It has very marine habits compared to most terns. This species is a rare vagrant to Western Europe and is also not normally found on the Pacific coasts of the Americas due to its pelagic habits, however in Baja California several nesting locations have been found. It breeds normally on islands throughout the equatorial zone.

Status: Least Concern. **Global Population:** 21,000,000 - 22,000,000 mature individuals. The overall population trend is uncertain, as some populations are decreasing, while others are increasing or are unknown.

Diet: These birds often fly in large flocks, catching small fish on the surface in marine environments

Nesting: Sexes appear the same in plumage. Adults in breeding plumage have their upper parts (including top of the head, nape, and upper surface of wings and tail) blackish, contrasting with a white patch on forehead, white under parts (tinged grayish), and white-edged outer

rectrices of tail.The under wing coverts are white, contrasting with dark under surface of the remiges. The white patch on the forehead extends on to the back to just above (not past) eye. The tail deeply forked, with the outermost pair of rectrices elongated. The bill and legs are black and the iris is dark brown. Adults in non-breeding plumage are similar, but there are blackish feathers of lores, crown, and nape with white margins (or these areas dark brownish). The outermost pair of rectrices are worn and shortened. Juveniles have plumage entirely sooty brown to blackish, with whitish and tan (occasionally chestnut) spots on some feathers of the back, scapulars, and upper wing, and with lower belly, under tail coverts, and the under wing coverts are smoky gray to whitish.

It breeds in colonies on rocky or coral islands creating a nest in a ground scrape or hole. It lays one to three eggs.

Cool Facts: It is known as the "Wideawake Tern" or just "Wideawake". These names refers to the non-stop calls produced by a colony of these birds, as does the Hawaiian name ‘ewa ‘ewa which roughly means "unpleasant noise".

Sooty Terns rarely come to land except to breed, and can stay out to sea either by soaring or floating on the water for between 3 to 10 years. It flies with steady, buoyant wing beats or soars.

- *O. f. fuscatus.* First reported by Linnaeus in 1766. The nominate breeds throughout species' range in Caribbean and Atlantic. Its under parts are mostly white (including the under wing and under tail coverts), with a slight gray tinge on flanks and belly.
- *O. f. crissalis.* First reported by Lawrence in 1871. It breeds in the Eastern Pacific Ocean from Isabel Island in Islas Revillagigedo and Clipperton Island south to Galápagos Islands. It ranges to the Pacific coast of Middle America from Baja California to Panama, and probably farther south. It is similar to the nominate, but its breast and posterior under parts more decidedly grayish.
- *O. f. luctuosus.* First reported by Philippi and Landbeck in 1866. It breeds on San Felix Island off the coast of Chile. It ranges to the Juan Fernandez Islands and the coast of Chile. It is similar to race *crissalis* but larger, grayer on the under parts, and more dusky on rectrices.
- *O. f. oahuensis.* First reported by Bloxham in 1826. Breeds tropical northern Pacific Ocean from Bonin Islands, Minami Tori Shima (Marcus Island), and the Hawaiian Archipelago south to Christmas Island. It is similar to race *crissalis*, but the bill is slightly heavier at base.
- *O. f. serratus.* First reported by Wagler in 1830. It breeds in western and northern Australia, New Guinea, and New Caledonia east across the South Pacific Ocean to Easter Island. It has a pale gray tinge to the under parts, but becomes paler with wear.
- *O. f. kermadeci.* First reported by Mathews in 1916. It breeds on the Kermadec Islands (Kermadec, Lord Howe, and Norfolk Island). It is very similar to race *serratus*.
- *O. f. nubilosus.* First reported by Sparrman in 1788. It breeds across the Indian Ocean, southern Red Sea, and Persian Gulf east to Greater Sunda Islands and the Western Pacific from the China Sea and the Philippines north to the Ryukyu Islands. It is very similar to race *serratus*, which is often lumped under this subspecies, but is slightly paler on the under parts.

Hawaiian Name: noiʻo
Common Name: Hawaiian Black Noddy
Scientific Name: *Anous minutus*

Size: 15 inches (38 cm)

Habitat: Oceania; throughout the Hawaiian Archipelago, including all islands of NWHI and the coastal cliffs and offshore islets of MHI. Outside of Hawaiʻi, noio (black noddy) breed on islands throughout the world's tropical oceans. Noio (black noddy) typically remain near (within 80 kilometers [50 miles]) their breeding colonies year-round.

Status: Least concern. **Global Population:** 2,000,000-3,000,000 mature individuals. In Hawaiʻi, population estimated at 12,000 breeding pairs with the largest populations occurring on Midway Atoll (6,000 pairs) and Nihoa (5,000 pairs). All sites in NWHI are free of rats and cats, however the MHI support large populations of non-native mammalian predators and like all seabirds, adults and nests are susceptible to predation by rats *(Rattus spp.*), and feral cats (*Felis silvestris*). Also ʻIwa or great frigatebirds (*Fregata minor*), Laysan Finches (*Telespiza cantans*), and shorebirds will depredate eggs and chicks. Kayak and zodiac tours of sea caves used for nest sites can result in adults flushing from nests, resulting in predation by native birds. And because noiʻo (black noddy) rely on predatory fish to drive prey to the surface, overfishing may eventually affect Hawaiian populations.

Diet: Primarily takes juvenile goatfish, lizardfish, herring, flying fish, and gobies. Often forages in large, mixed species flocks associated with schools of large predatory fishes which drive prey

species to the surface. Noi'o generally forage in near shore waters and feeds mainly by dipping the surface from the wing or by making shallow dives.

Nesting: Individuals have slender wings, a wedge-shaped tail, and black bill which is slightly decurved. Adult males and females are sooty black with a white cap and have reddish brown legs and feet. The bill is slightly decurved.

These birds make nests in caves, or rocky ledges of sea cliffs in late spring. Usually, Noi'o nest together as a colony. The females lay only one egg each year. They can often be seen hunting fish near their nesting sites. Established pairs return to the same nest site year after year. Breeding is highly variable and egg laying occurs year-round. Both parents incubate the single egg, as well as brooding and feeding the chick. Birds first breed at two to three years of age, and the oldest known individual was 25 years old.

Cool Facts: Noi'o are unusual because they are endemic coastal birds that reside in Hawai'i year round, while most of Hawaiian sea birds spend winters in Hawai'i, and leave in summer to breed in the arctic. Their cousins, Noi'o Koha, or Brown Noddys, nest on the ground, and because of this have not survived on the main islands, where they have been wiped out by predators.

Flight is swift with rapid wing beats and usually direct and low over the ocean; this species almost never soars high.

Seven noi'o (black noddy) subspecies are generally recognized, and two are resident in Hawai'i (Races *melanogenys* and *marcusi)*.

- *A. m. americanus*. First reported by Mathews in 1912. It is found in the Caribbean islands. It is similar to the nominate but has a stouter bill and browner tail.
- *A. m.* melanogenys. First reported by Gray in 1846. It is found in the Hawaiian Islands. It had the has shortest wing and tail.
- *A. m. diamesus*. First reported by Heller and Snodgrass in 1901. It is found in the eastern-central Pacific at Clipperton Island, Cocos Island and Malpelo Island. It has the longest wings and tail of the subspecies.
- *A. m. worcester.* First reported by McGregor in 1911. It is found on Cavilli Island and the Tubbataha Reef (Sulu Sea), also the Java Sea, and (perhaps) the Ashmore Reef (off northwestern Australia. It disperses to the eastern Indian Ocean.
- *A. m. minutus.* First reported by Boie in 1844. The nominate subspecies is found on the coasts of northeastern Australia and eastern New Guinea, the Bismarck Archipelago, the Solomon Islands and locally through Melanesia (excluding Vanuatu) and Polynesia to the Tuamotu Islands.
- *A. m. marcusi.* First reported by Bryan in 1903. It is found on Marcus Island (Minami Tori-shima) and Wake Island southward through Micronesia to the Caroline Islands.
- *A. m. atlanticus.* First reported by Mathews in 1912. It is found on several Atlantic islands: St Paul, Fernando de Noronha and Martim Vaz (off eastern Brazil), Ascension and St Helena (formerly also Inaccessible) north and eastward to islands in Gulf of Guinea (western Africa). This race has a longer, stouter bill and longer wings than *minutus*. The tail is noticeably blackish, and white on head is more restricted to crown. It differs from race *diamesus* in having lighter shoulders, under body, and the sides of head and neck.

Hawaiian Name: āeʻo

Common Name: Black-necked (Hawaiian) Stilt

Scientific Name: *Himantopus mexicanus*

Size: 16 inches (40.6 cm)

Habitat: Oceania; endemic to the Hawaiian Islands, USA. The āeʻo can still be found on all the major islands except Kahoʻolawe. Stilt numbers have varied from 1,100 to 1,783 between 1997 and 2007, according to state biannual waterbird survey data, with Mau'i and Oʻahu accounting for 60-80% of them. On Oahu, the largest numbers are found at Pearl Harbor and Kaneohe.

Studies have proven that the stilts fly from one island to another. The āeʻo requires shallow brackish water ponds, mud flats and shorelines where it finds its diet of small invertebrates.

Status: **Endangered.**
Global Population: 1500 mature individuals. The aeʻo was once a popular game bird, but waterbird hunting was banned in 1939. State and Federal effort in protecting wetlands, enforcing strict hunting laws, educating, and working with private organizations and landowners, play an important role in ensuring the livelihood of the aeʻo and many other waterbirds.

The primary causes of the decline of this Hawaiian native waterbird has been the loss and degradation of wetland habitat and introduced predators (e.g., rats, dogs, cats, mongoose). Other factors include alien plants, introduced fish, bull frogs, disease, and sometimes environmental contaminants.

Four stilt eggs were received in 1980 from the U.S. Fish and Wildlife Service, and were among the first to be raised and studied in a successful in-zoo propagation program at the Honolulu Zoo. Since then more stilts have been raised at the zoo, including the ones seen in the Hawaiian water bird exhibit. Because it is often hard to observe all aspects of stilt behavior in the wild, the zoo program allows us to observe this endangered species more closely, and the information gathered can help not only in propagation but in protection of this unique Hawaiian bird.

Diet: Wide variety of invertebrates and other aquatic organisms (worms, crabs, fish). They like to loaf around in open mudflats, sparsely vegetated pickleweed mats, and open pasture lands perhaps because visibility is good. Specific water depths of 13 cm (5 inches) are required for optimal foraging.

Nesting: They have long pink to orangish legs, a long thin black bill and are blackish above and white below, with a white head and neck with a varying amount of black. Males have a black back, often with greenish gloss. Females' backs have a brown hue, contrasting with the black remiges. In the populations in which the males usually get all-white heads in winter, females tend to have less black on head and neck all year round, while males often have much black, particularly in the summer. However this difference is not clear-cut.

Nest sites are frequently separated from feeding sites and stilts move between these areas daily. Nesting sites are adjacent to or on low islands within bodies of fresh, brackish, or salt water. The nest site is a bare spot on the ground near water. The stilt lays 3-4 eggs.

Cool Facts: The āeʻo is the only breeding shorebird in Hawaii. It has a flapping flight, its long legs stretched out straight behind it. It forms small flocks of varying numbers.

The mature birds use tricks such as a "broken wing act" to lure intruders away from the nest area. It has a short sharp cry, "keek," that is given in flight and on the ground when disturbed. A soft muted call is given when resting.

Hawaiian Name: ʻalae keʻokeʻo
Common Name: Hawaiian Coot
Scientific Name: *Fulica alai*

Size: 13-16 inches (30-40.6 cm); **Wingspan:** 23-28 inches (58-71 cm)

Habitat: Oceania; the Hawaiian Islands. On Kauaʻi, Hawaiian Coot are usually found in lowland valleys, while the Oʻahu populations are on the coastal wetlands. Mau'i Nui (Maui, Molokaʻi and Lanaʻi) has the second largest population in the state (Oʻahu is first). They are found at the islands' two largest wetlands: Kealia Pond National Wildlife Refuge and Kanaha Pond State Bird Sanctuary. The Big Island populations are found at ʻAimakapa and ʻOpaeʻula Ponds on the Kona coast, and at Waiakea and Loko Waka Ponds in Hilo.

Its natural habitats are freshwater lakes, freshwater marshes, coastal saline lagoons, and water storage areas.

Status: Endangered. Global population: 1,500-2,000 adult individuals. The Hawaiian Coot was listed as an endangered species in 1967 under the Federal Endangered Species Act.

On Oahu, Mau'i, Molokai and Kaua'i, the Hawaiian Coot was previously abundant in coastal brackish and fresh-water ponds, streams, and marshes; however, the first

censuses conducted in the 1950s and 1960s detected fewer than 1,000 birds statewide. Since the 1960s, the inter-annual population size has fluctuated from less than 1,000 birds to over 3,000, and appears to be gradually increasing. Biannual surveys conducted by the Hawaiian Department of Land and Natural Resource's Division of Forestry and Wildlife (DOFAW) found that between 1998 and 2003 the inter-island coot population averaged 2,100 birds, ranging between 1,500 and 3,000 birds. Recent surveys estimated winter populations fluctuating around 1,500 birds and a summer population fluctuating around 2,000 birds.

Throughout its range, wetlands have been destroyed by drainage for cultivation and developments such as hotels, housing areas, golf courses, shopping centers, landfill sites, military installations, roads and industrial sites. Some water-bodies have become overgrown by introduced plants. On O`ahu, artificial wetlands associated with sugarcane plantations have disappeared as these industries have declined on the island.

Introduced predators are an additional threat including the black rat (*Rattus rattus)*, brown rat (*Rattus norwegicus)*, domestic cats and dogs, Asian mongoose (*Herpestes javanicus)* and Cattle Egret (*Bubulcus ibis)* . The Asian mongoose is known to take the eggs, young birds and nesting adults of wetland bird species. Predation appears to be a serious problem on golf courses, where the Hawaiian Coot is most abundant.
The species may be poisoned by insecticides and herbicides used to treat water channels on agricultural land and golf courses, as well.

Diet: Omnivorous diet consisting of seeds and leaves of aquatic plants, insects, tadpoles, and small fish. They usually dive for food but can also forage and scavenge on land.

Nesting: Sexes are alike with males being larger than females. Adult coots are dark slate gray with a white bill and a large frontal shield (patch on top of head). The frontal shield is usually white but can vary from bluish white to yellow to dark blood red. The bill has a small black stripe towards its end. They have white under-tail feathers that are seen when swimming or during their courtship displays. This coot has grayish, yellow tinged feet.

Their calls include a variety of short, harsh croaks, often given at night.

Adults undergo a post-breeding flightless molt period, with flocks of molting birds congregating from June-September. The species is diurnally active and roosts at sunset solitarily or in flocks.

The nest is a platform of vegetation that may be resting on the bottom of shallow water, floating or on a foundation of trampled plant matter in emergent vegetation. The species may also nest on artificial platforms, islands, rafts, tree stumps, tree forks or in bushes up to 3 m above the water. Up to 10 eggs are laid but nest predation from herons and gulls significantly reduce the amount of young who survive.

Cool Facts: The Hawaiian Coot was once a popular game bird, but waterbird hunting was banned in 1939. State and Federal effort in protecting wetlands, enforcing strict hunting laws, educating, and working with private organizations and landowners, play an important role in ensuring the livelihood of the Hawaiian Coot and many other waterfowl.

Hawaiian Coot, Hawai'i (Photo: Ken Gilliland)

Hawaiian Name: ʻIo
Common Name: Hawaiian Hawk
Scientific Name: *Buteo solitarius*

Size: 16-18 inches (40-46 cm); **Wingspan:** 37-41 inches (95-103 cm)

Habitat: Oceania; endemic to Hawai`i in the Hawaiian Islands with vagrants recorded on Mau'i, O'ahu and Kaua'i.

It occurs in a broad range of habitats up to 2,700 m, from lowland agricultural areas to all types of forest.

Status: Near Threatened to Endangered. **Global population:** 1,100 adult individuals. While the current population is stable, continuing threats include the conversion of land used for pasture and sugar-cane to eucalyptus plantations, residential development in extensive areas of subdivided land, mainly in the Puna District, forest clearance for agricultural and other developments, logging, repeated nest disturbance, perhaps road-kills and the very significant threat caused by the introduction of ungulates that degrade

native forests and inhibit their regeneration, which facilitates the spread of exotic plants that then out-compete remaining native plants. Most successful nesting of the Hawaiian Hawk is confined to higher elevation native forest with 'ohi'a trees. But this nesting habitat in particular has been reduced due to competition from exotic plants. Formerly it suffered extensively from shooting and may come into conflict with future efforts to reintroduce the Critically Endangered Hawaiian Crow (*Corvus hawaiiensis*) and other endangered songbirds, which it preys upon.

It benefits from some anthropogenic changes, for example, it feeds on introduced game-birds, passerines and rodents, and uses edge habitat around sugar-cane fields and orchards for hunting.

The species is protected as an endangered species in the United States. However, the IUCN classifies the species as Near Threatened.

Diet: Rats, small birds, stream animals, crickets, praying mantises, millipedes, centipedes, lizards, and occasionally worms. It also fed on the Hawaiian crow, which is now extinct in the wild.

The ‘Io usually hunts from a stationary position, but can also dive on prey from the air.

Nesting: While sexes are alike, females are noticeably larger than males. Two color phases exist: a dark phase (dark brown head, breast, and underwings), and a light color phase (dark head, light breast and light underwings). Feet and legs are yellowish in adults and greenish in juveniles. During breeding season one of the pair, possibly the female, has a distinctive yellow forecap area just above the upper mandible.

The most successful nesting is restricted to native `ohi`a trees (*Metrosideros polymorpha)*, which are slow growing and generally in decline.

They nest from March through September, and usually lay only one egg but sometimes they could lay up to three in their clutch. The female does the majority of sitting during the 38 days of incubation, while the male does the majority of the hunting. After the egg is hatched, the female only allows the male to visit when delivering food to the nest. The chick fledges at seven or eight weeks. Parents feed nestlings with mostly mammalian and avian prey.

Cool Facts: The Hawaiian hawk was a royal symbol in Hawaiian legend, and it is sometimes called “‘iolani,” or “exalted hawk”, which was the name of Kamehameha IV and the ‘Iolani Palace.

The adaptation of the Hawaiian hawk is that their body colors blend within trees and plants, and they have big talons to catch fish.

Hawaiian Name: pueo
Common Name: Hawaiian Owl
Scientific Name: *Asio flammeus sandwichensis*

Size: Males 13 – 17 inches (33-43 cm) Wingspan 41 inches (105 cm)

Habitat: Polynesia. Endemic to the Hawaiian Islands. Pueo occupy a variety of habitats, including wet and dry forests, but are most common in open habitats such as grasslands, shrublands, and montane parklands, including urban areas and those actively managed for conservation.

Status: Endangered. Global population: unknown. They are strongly affected by light pollution They are often killed in vehicular accidents in which they dive toward the headlights of cars, possibly in an attempt to hunt. Populations have dropped dramatically around newly-built roadways.

While the Pueo appears to be somewhat resistant to the avian malaria they have recently become victim to a mysterious "Sick Owl Syndrome", or SOS, in which large numbers of Pueo have been found walking dazedly on roads, leading to death by collision. The cause of Sick Owl Syndrome is unknown; it is suspected that pesticide toxicity may be responsible, particularly through secondary rodenticide poisoning. However, it has also been hypothesized that the cause may be an infectious agent, seizure-like confusion due to light pollution, or a variety of other causes.

Pueo nest on the ground, which makes their eggs and young susceptible to predation by the introduced Small Asian Mongoose and other predators, as well as by bulldozers.

State listed as Endangered on O‘ahu.

Diet: Small mammals

Nesting: Females are slightly larger. Males perform aerial displays known as a sky dancing display to prospective females. Nests are constructed by females and are comprised of simple scrapes in the ground lined with grasses and feather down. Females also perform all incubating and brooding. Males feed females and defend nests. Chicks hatch synchronously and are fed by female with food delivered by male. Young may fledge from nest on foot before they are able to fly and depend on their parents for approximately two months.

Cool Facts: This taxon was first named by Andrew Bloxam (as the species *Strix sandwichensi*s). He saw it in 1825 as the naturalist on board HMS Blonde. Later the owl was reclassified as a subspecies of the Short-eared Owl (*Asio flammeus).*

Unlike most owls, Pueo are active during the day, and are commonly seen hovering or soaring over open areas. Their relatively recent establishment on Hawai‘i may have been tied to the rats (*Rattus exulans*) that Polynesians brought to the islands.

Pueo mean “huddled” or “crouched” in Hawaiian.

Hawaiian Name: ʻŌʻō
Common Name: Bishop's ʻŌʻō
Scientific Name: *Moho bishopi*

Size: 8.1-9.5 inches (25-30 cm)

Habitat: Oceania; Endemic to Molokaʻi, and possibly Mau'i (unconfirmed sightings in 1901 and 1982). Hawaiian Islands (USA). Historically, it probably was found throughout Molokaʻi from sea level to the mountaintops.

It was found in high montane forests, including cliffs, in dense tangled brush of boggy mountaintops, and low brush. It was also found in areas dominated by ʻöhiʻa forests on Molokaʻi. Quoting Henry Palmer, "It was found in the lower and upper forest-region, but more in the latter." More recent sighting (1982) on northeast flank of Haleakalä Crater, Mau'i, was in montane rain forest of ʻöhiʻa, with understory of ʻölapa (*Cheirodendron trigynum*), pilo (*Coprosma ochracea*), and pükiawe (*Styphelia tameiameiae*).

Status: Extinct (1987). Global Population: 0 mature individuals left. It was considered widespread until the late 1800s. It disappeared completely about 1904. An invasion by black rat , possibly supplemented by avian pox, was likely the cause of its final demise. It may have been extant in remote Northeastern. Mau'i into 1980s.

Diet: Primarily nectarivorous, with nectar of lobelias and ʻöhiʻa constituting major portion of its diet.

Somewhat gregarious, probably during non-breeding season. Perkins (1903) described seeing "about a score of the ʻŌʻō that I watched while they were feeding, at a time when the ʻöhiʻas and lobelias were both in flower," and Munro wrote "saw a group of about half a dozen in 1904." It was said to be somewhat curious, but restless and shy when closely approached and readily attracted by imitation of its calls.

Breeding: It was similar in size to O'ahu and Hawai'i ʻŌʻō. Sexes, as with other ʻŌʻōs, were similar in plumage, but males were considerably larger than females (26-31 cm for males, 25-27 cm for females). The slender, sharp, and slightly decurved bill was about equal to head in length. The tail was long and graduated with the tip of the R1 in male being attenuated, becoming filamentous and sweeping upward with slight curl. As with the O'ahu ʻŌʻō, the rectrices were broader in males than in females. Legs were long and the feet large. The crown-feathers stiff, with scaly pattern. There were fine black bristles extending outward on chin and throat. The crown, lores, and auricular were black, with a purple gloss. The nape, sides of the neck, throat, back, rump, sides, flanks, and belly were smoky black, with white feather shafts forming fine streaks. The wings were sootywith brown tone. The under wing coverts were black, or in some individuals mottled with white (latter may be related to age or sex). The auricular and axillary tufts were black at the base with the crissum a bright yellow. The tail was black, sometimes narrowly tipped white on one or both webs.

There is no breeding information recorded for this species.

Cool Facts: It was named in honor of Charles R. Bishop, founder of the Bernice P. Bishop Museum, Honolulu.

Hawaiian Name: ʻŌʻō
Common Name: Kaua'i ʻŌʻō
Scientific Name: *Moho braccatus*

Size: 8.1-9.5 inches (20.6-24.2 cm)

Habitat: Oceania; Endemic to Kaua'i. Hawaiian Islands (USA). Last seen on Mount Waiʻaleʻale (elevation 1,569 m), which is one of the wettest places on Earth, with mean annual rainfall of 1,415 cm. Formerly (1899 and earlier), it was widespread throughout Kauaʻi forests from sea level to near mountain summits.

Inhabited forests from sea level to mountaintops on Kauaʻi. By early 1900s, it was confined to higher-elevation forests, principally Alakaʻi Swamp in central part of the island. The Alakaʻi swamp is not a true swamp, but a high montane plateau dissected by numerous forested ravines and valleys and bordered by sheer, deep canyons.

Status: **Extinct (1987).** **Global Population:** 0 mature individuals left. The species became extinct from a large range of problems, including mosquito-transmitted diseases (which caused the species to retreat to higher ground, ultimately retreating to high-altitude montane forests in the Alakaʻi Wilderness Preserve), introduction of mammalian predators (particularly the black rat), and deforestation. Higher elevation forests lack tree cavities, so few, if any, nests could be made.

The final blow was two hurricanes coming within ten years of each other They destroyed many of the old trees with cavities, and prohibited tree growth when the second one arrived, causing the species to disappear. The bird was last sighted in 1985, and the last sound recording was made in 1987 by David Boynton. It is still believed by some that the species may survive undetected, as the species had already been proclaimed extinct twice: once in the 1940s (later rediscovered in 1950) and again from the late 1950s to the early 1970s, being rediscovered by the wildlife biologist John Sincock. However, it has a loud and distinctive call, and intensive surveys have failed to find any since 1987.

Diet: Primarily nectarivorous, including in its diet the nectar of 'öhi'a, lapalapa, tree lobelias, kanawao, and banana. Also took 'ie'ie flower bracts, small fruits and seeds of lapalapa, cockroaches and crickets, true bugs (*Hemiptera*), moths, beetles, other adult insects and larvae, spiders, millipedes, and small terrestrial snails.

ʻŌʻōs forage on trunks of live and dead trees, large and small branches and twigs, foliage, and epiphytic mats of the forest canopy. It moved quickly and decisively, frequently holding tail cocked in 30–80° angle.

Breeding: The smallest of the Hawaiian honeyeaters. Sexes were similar in appearance, but females were generally smaller. The head, wings, and tail were black. The crown-feathers, forehead and crown were more intensely black than rest of plumage and slightly glossy. Crown sometimes was sparingly streaked with white. The bill was about equal to head in length and slender, sharp, and slightly decurved. There were fine black bristles on chin and throat. The back was slaty brown, with the rump and upper tail coverts being a paler brown. The bend of the wing and under wing coverts were white. The axillaries were pale grayish buff and tufts undeveloped. The chin, throat, and upper breast were black, with transverse subterminal subtle white bars giving scaly-like appearance. The lower breast and belly were slaty brown and the unde rtail coverts a rufous-brown. The tail was short, graduated, and frequently held cocked upward. The feathered part of leg was a bright yellow in adults and black in immatures. The legs were long and the feet large. It had a pale eye.

Breeding season occured in April and May. The bird was a cavity nester in the thickly forested canyons of Kauaʻi. The only nest examined contained 2 small young of undetermined age.

Cool Facts: The Kaua'I ʻŌʻō had the least amount of yellow feathering in its plumage among the 4 black-plumaged ʻŌʻō species, and was the last to go extinct.

In the 1970s, the only known footage of the bird was filmed by John L. Sincock on Super 8 film and several song recordings were made as well (with Harold Douglas Pratt, Jr. being one of the people involved in recording the songs).

Hawaiian Name: ʻŌʻō
Common Name: O’ahu ʻŌʻō
Scientific Name: *Moho apicalis*

Size: 12 inches (30.5 cm)

Habitat: Oceania; Endemic to O’ahu. Hawaiian Islands (USA). Its habitat was the mountain forests on Oʻahu.

Status: **Extinct (1837).** **Global Population:** 0 mature individuals left. The reasons for its extinction were probably avian diseases caused by introduced mosquitos, habitat destruction by cattle and goats, deforestation, predation by introduced rats, and hunting (their plumage was used in robes for the Hawaiian nobility). The population was large (probably in the thousands) sometime before Western contact (1778), since substantial numbers of O'ahu 'Ö'ö were taken for Hawaiian feather work without a significant population drop.

Diet: Flower nectar and fruit. ʻŌʻōs forage in the lofty branches of the forest canopy.

Breeding: Sexes were alike in appearance, but males were 20–25% larger than females. The plumage was overall sooty brownish-black, glossy black on crown. The under wing were coverts with bright-yellow sides, flanks, and under tail coverts. There was a striking pattern of blackish-brown and white wavy bars on the under surface of the tail, which appears as white spots dorsally when tail is flared.The two narrow central tail feathers which changed into fine hair-like or fibrous tips. The bill and the tarsus were black.

Its biology and nesting behaviors were not well-studied.

Cool Facts: While in the Hawaiian Islands in 1825 as the naturalist on board HMS Blonde, Andrew Bloxam, first saw live Oʻahu ʻŌʻō s which were brought to him by locals. He preserved one specimen obtained in this way. He wrote in his diary (not published until much later): "They are now very scarce in all the islands. I did not see even one in the different excursions I made, & the natives asked a high price for the very few they brought to me." Bloxam misidentified his birds as the species now called *Moho nobilis.*

John Gould scientifically named and described the Oʻahu ʻŌʻō in 1860, when it was already regarded as vanished for 23 years. The last reliable evidence was a collection of about three birds by German naturalist Ferdinand Deppe in 1837. He found these specimens in the hills behind the capital Honolulu.

After surveys, led for example by ornithologist Robert C. L. Perkins, failed to find the bird between 1880 and 1890, it was described as almost extinct. Today there are seven specimens in the museum collections in Berlin, London, New York City and Cambridge (Massachusetts).

Named after an imitation of the loud, harsh 'oh-oh' call it made. The brilliant yellow feathers were extensively used by the native Hawaiians to make royal feather work. The royal bird-catcher guild used a sticky substance spread on the branches of an ohia tree to trap this bird, plucked a few of the yellow feathers and released the bird.

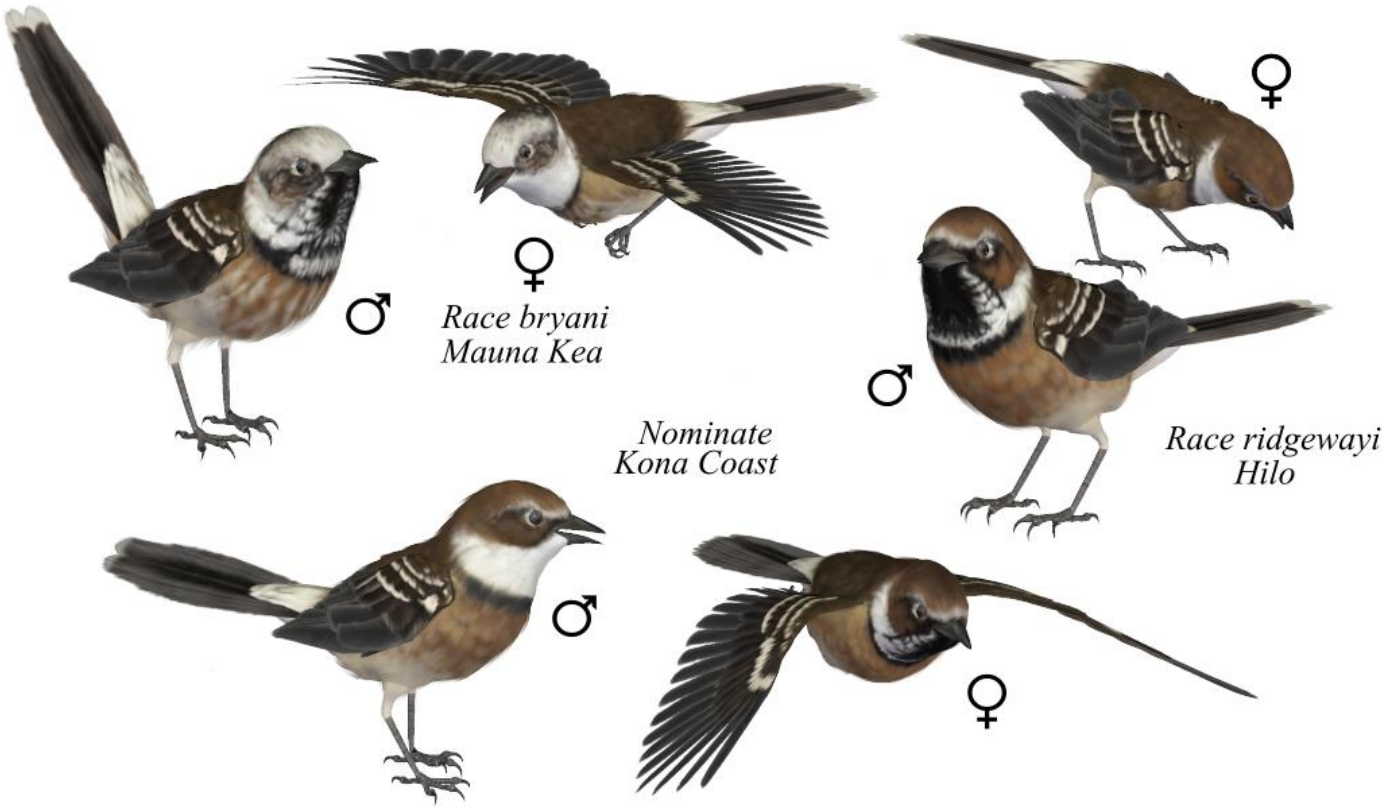
A mix of lava and forest is a common sight in Hawai'i (Photo: Ken Gilliland)

Hawaiian Name: ‘elepai’o
Common Name: Hawaiian Wren
Scientific Name: *Chasiempis sandwichensis*

Size: 6 inches (14-16 cm)

Habitat: Oceania; Hawaiian Islands. On Hawai`i, race *bryani (Mauna Kea*) occupies arid, mostly high-altitude mamane and mamane-naio woodland, while the nominate race (*Kona Coast)* occurs in mesic habitats on western and south-western slopes, and race *ridgwayi (Hilo)* is restricted to the wet eastern slopes.

Status: **Vulnerable.** **Global Population:** 216,000 mature individuals with an overall declining population trend. The nominates population seems to be stable at about 60,000–65,000 birds; Race ridgwayi is the most common subspecies today, with a population of around 100,000-150,000; and Race bryani it is the rarest Big Island subspecies, with a population of 2,000–2,500 birds.



The habitat of the 'elepai’o has been heavily browsed by feral ungulates and introduced grasses suppress regeneration and potentially increase the risk of fire.

Human activity and refuse, such as old tires, bathtubs, ditches, and stock ponds, may create breeding habitat for mosquitoes that can transmit avian malaria and pox virus. Non-native species introduced by humans can affect ‘elepai’os in several ways. Introduced black rats and

cats prey on young, and occasionally adults. Cavities and wallows created by rooting of feral pigs also provide breeding habitat for mosquitoes, and areas where feral pigs destroyed the ground cover were used less than expected as foraging sites by Hawai'i 'elepai'o. Introduced birds, including Japanese White-eye, may compete with 'elepai'o for food or space. The abundance of 'elepai'os was negatively correlated with abundance of Japanese White-eyes.

No measures taken specifically for the Hawai'i 'elepai'o, but conservation measures aimed at several endangered forest birds, such as the Akiapola'au (*Hemignathus munroi*), Akepa (*Loxops coccineus*), Hawai'ii Creeper (*Loxops mana*), and Palila (*Loxioides bailleui*), have benefited all forest birds on the island, including the the 'elepai'o.

Diet: Insects and other invertebrates; occasionally some seed and fruit.

They are versatile foragers and use a remarkable variety of behaviors to search for and capture prey at all heights and on all substrates in the forest, including the ground, tree trunks, branches, leaves, and in the air. Bold and inquisitive, elepaios often investigate and even follow hikers, holding their tail cocked up in a curious posture, and can be attracted easily by squeaking.

Breeding: It is small flycatcher with a long tail (which is often held up at an angle). Adults have conspicuous white wing bars, rump, and tips of rectrices. It is dark brown to grayish-brown on the crown and back, with a contrasting eyebrow and forehead of rufous to white. The under parts are buff to white with light to heavy brown streaks on breast. The bill is of medium length, blunt, and mostly black. The base of the mandible is blue-gray in adults and yellow in juveniles and second-year birds. Males average about 10% larger than females and have black throats speckled with some white (female throats are pure white).

There are substantial regional variation in coloration caused by climate and also individual variation within locations. Appearance also varies with age due to two-year delay in plumage maturation in both sexes. Juveniles and second-year sub-adults are gray-brown above, whitish below, with rusty wing bars while third-year sub-adults are closer to adults, but with the wing bars, rump, and throat partly cinnamon-colored.

It nests between January and June. Unlike Hawaiian honeycreepers, both males and females participate almost equally in all aspects of rearing. Finely woven cup nests are built in a variety of native and nonnative trees. Clutch size is usually two and second and third nests are attempted after failures, but rarely is a second nest attempted if the first is successful.

Cool Facts: Sexual dimorphism in throat color is more pronounced on younger islands (Hawai'i) than on older islands (Kaua'i and O'ahu).

Hawaiians consider a visit by an 'elepai'o good luck. In fact, in order to select the proper Koa tree for a canoe it first has to be landed on by an 'elepaio. They considered it their guardian spirit, an incarnation of their patron goddess Lea, because if the bird pecked at a fallen tree, it was a sign that the tree was riddled with burrowing insects and thus not good anymore, but when the bird showed no interest in a tree, it indicated that the wood was suitable. This is the origin of the ancient Hawaiian proverb, 'Uā 'elepai'o 'ia ka wa'a ("The canoe is marked out by the 'elepai'o").

Being a flycatcher, farmers believed the 'elepai'o to be the incarnation of Lea's sister goddess, Hina-puku-'ai, who protected food plants and was a patron of agriculture.

The ‘elepai’o is the first native bird to sing in the morning and the last to stop singing at night; apart from whistled and chattering contact and alarm calls, it is probably best known for its song, from which derives the common name: a pleasant and rather loud warble which sounds like e-le-PAI-o, hence the Hawaiian name.

There are 3 subspecies of Hawaiian Elepaio:

- *C. s. sandwichensis.* First reported by Gmelin in 1789. The nominate subspecies, the “Kona Coast” elepaio is found in the drier areas in the west and south of the big Island of Hawai’i.
- *C. s. bryani*. First reported by Pratt in 1979. The “Mauna Kea” elepaio is found on the slopes of Mauna Kea. It differs from the nominate in having a mostly white eyebrow and auricular, grayer crown and back. It has longer white tips on tail and wing bars, and a more lightly streaked breast.
- *C. s. ridgwayi.* First reported by Stejneger in 1887. The “Hilo Coast” elepaio is found in the wet slopes in Hilo district of the Big Island of Hawai’i. It is paler cheeks on the nominate.

Typical ‘elepai’o foraging area (Photo: Ken Gilliland)

Hawaiian Name: ‘elepai’o
Common Name: Kaua’i Wren
Scientific Name: *Chasiempis sclateri*

Size: 6 inches (14-16 cm)

Habitat: Oceania; Hawaiian Islands. Endemic to Kaua`i.

It is most abundant in wet to mesic montane forest, also occurring in woodland, scrub, savanna and drier habitats at lower densities.

Status: **Vulnerable.** **Global Population:** 50,000 Mature individuals with an increasing population trend. It numbered 40,000 around 1970, but declined by half in the 1990s. Whether this fluctuation is natural and thus the birds' numbers will rebound or whether it signifies a novel threat remains to be seen. However, it seems the birds are making a recovery, as population density on the Alakai plateau has increased by 13% in recent years.

Hurricane Iniki, in 1992, drastically reduced all populations. Although the species is recovering well in some areas, it is decreasing in others and it remains vulnerable to future catastrophic events such as hurricanes. Diseases, such as avian pox and malaria, spread by mosquitoes, are a problem at all elevations, increasing mortality and possibly preventing birds from nesting. High prevalence of mosquito-borne diseases and local declines in the species's population are associated with high rainfall and prevalence is likely to increase with climate change. The species is increasing in some areas despite the potentially negative impacts of introduced species, with house cats being potential predators, rats (a documented nest predator), and ungulates and alien plant species causing habitat degradation. However, it is decreasing in others, and it remains susceptible to the consequences of further introductions.

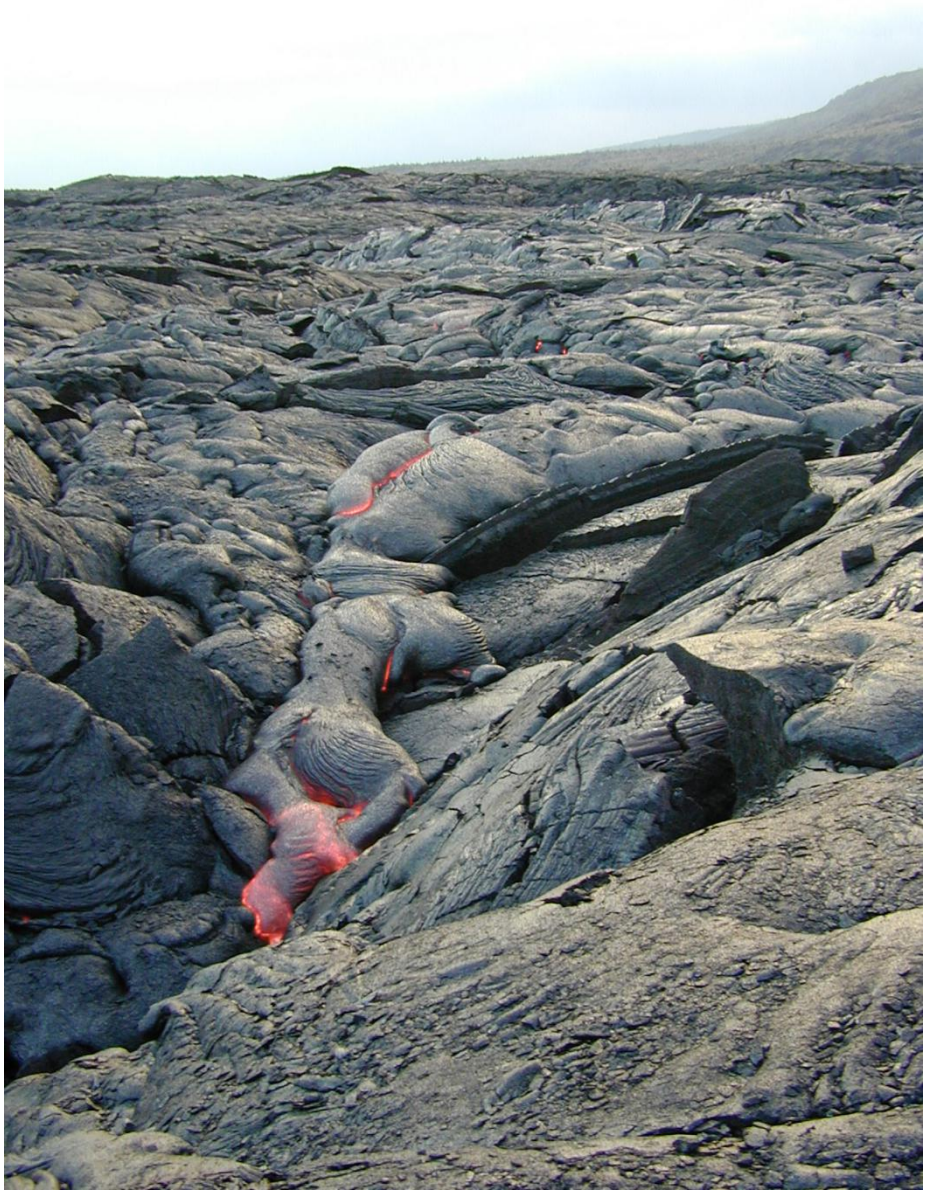
Diet: Insects and other invertebrates; occasionally some seed and fruit.

Breeding: It is small flycatcher with a long tail (which is often held up at an angle). Adults have conspicuous white wing bars, rump, and tips of rectrices. It is dark gray on the crown and back, with a contrasting eyebrow and forehead of rufous to white. The under parts are buff to white with an orange-brownish wash on breast. The bill is of medium length, blunt, and mostly black. The base of the mandible is blue-gray in adults and yellow in juveniles and second-year birds. Males average about 10% larger than females.

It nests between January and June. Unlike Hawaiian honeycreepers, both males and females participate almost equally in all aspects of rearing. Finely woven cup nests are built in a variety of native and nonnative trees. Clutch size is usually two and second and third nests are attempted after failures, but rarely is a second nest attempted if the first is successful.

Cool Facts: The Kaua‘i ‘elepaio was formerly considered as a subspecies of the Hawai'i ‘elepai'o until reclassified as a separate species in 2010.

The ‘elepai’o is the first native bird to sing in the morning and the last to stop singing at night; apart from whistled and chattering contact and alarm calls, it is probably best known for its song, from which derives the common name: a pleasant and rather loud warble which sounds like e-le-PAI-o, hence the Hawaiian name.



Lava Flow at Volcano National Park (Photo: Ken Gilliland)

Hawaiian Name: ‘elepai’o
Common Name: O’ahu Wren
Scientific Name: *Chasiempis ibidis*

Size: 6 inches (14-16 cm)

Habitat: Oceania; Hawaiian Islands. This species is endemic to O`ahu.

It is most abundant in the mesic forests of the valleys.

Status: Endangered. Global Population: 1,261 mature individuals with a declining population trend. On O`ahu habitat loss to development has been extensive, with 56% of the former range of ibidis zoned for agricultural or urban development. Diseases, such as avain pox and malaria, spread by mosquitos, are a problem at low and middle elevations on all islands, increasing mortality of adults by about 25% on O`ahu, and possibly preventing birds from nesting. Malaria prevalence in the species on O`ahu has been recorded at 87%, with 36% of birds showing signs of avian pox. High prevalences in mosquito-borne diseases and local declines in the species's population are associated with high rainfall. Nest-predation by black rats is the most serious current problem on O`ahu. Fires are known to destroy key habitat and promote the spread of alien plants on O`ahu.

It is now restricted to an area of 47 square kilometers (18 sq mi) in the Koʻolau and Waiʻanae ranges, where a fragmented population of 1,200-1,400 birds occurs. Recently completed surveys of populations in the Koʻolau range have unexpectedly revealed that the population has largely remained stable since surveys conducted in the 1990s. However, only about 20 individuals are left on the windward side of the Koʻolau range, with some valleys containing only a single ‘elepaio. Without intervention, this population faces extirpation in the near future due to small population phenomena.

Diet: Insects and other invertebrates; occasionally some seed and fruit.

Breeding: It is small flycatcher with a long tail (which is often held up at an angle). Adults have conspicuous white wing bars, rump, and tips of rectrices. The bill is of medium length, blunt, and mostly black. The base of the mandible is blue-gray in adults and yellow in juveniles and second-year birds. Males average about 10% larger than females. It has a dark brown crown and back. the under parts are white, with very light to moderate brown streaks on upper breast. The lores are white and the auriculars are mostly black with the eyebrow and forehead being rufous, forming a contrasting pattern. The male is usually more black on throat than female, especially chin, but sexes are not always distinguishable. Some regional variation in coloration caused by climate; birds in drier environments generally paler and grayer. Juveniles and

second- and third-year subadults have rich rufous on their head, back, and upper breast, with rufous wing bars.

It nests between January and June. Unlike Hawaiian honeycreepers, both males and females participate almost equally in all aspects of rearing. Finely woven cup nests are built in a variety of native and nonnative trees. Clutch size is usually two and second and third nests are attempted after failures, but rarely is a second nest attempted if the first is successful.

Cool Facts: The Oʻahu ʻelepaio was formerly considered as a subspecies of the Hawai'i ʻelepaio until reclassified as a separate species in 2010. This species looks very similar to the Hawaiʻi ʻelepaio, but the white underside extends to the flanks and further up the breast, and the upperside, especially the head, is more rust-colored.

The ʻelepai'o is the first native bird to sing in the morning and the last to stop singing at night; apart from whistled and chattering contact and alarm calls, it is probably best known for its song, from which derives the common name: a pleasant and rather loud warble which sounds like e-le-PAI-o, hence the Hawaiian name.

Fog rolls through a Hawaiian grassland habitat (Photo: Ken Gilliland)

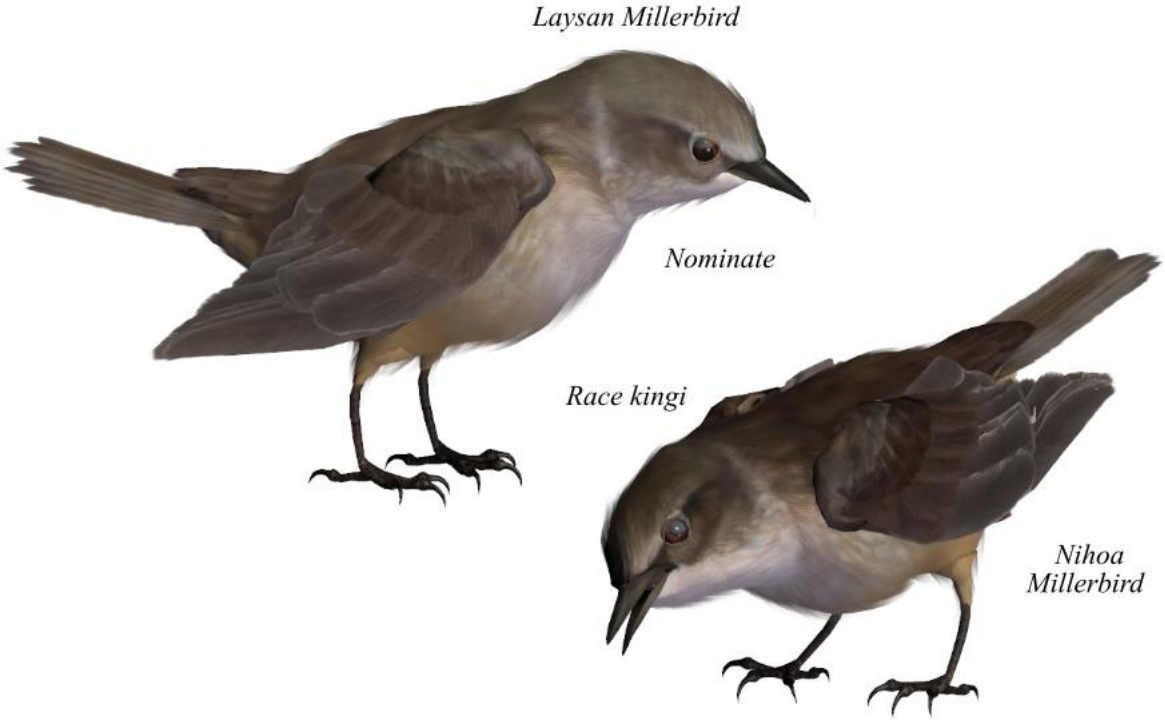
Hawaiian Name: (unknown)
Common Name: Laysan and Nihoa Millerbird
Scientific Name: *Acrocephalus familiaris*

Size: 5.1 inches (13 cm)

Habitat: Oceania; Polynesia. It is endemic to the steep, rocky island of Nihoa in the North-western Hawaiian Islands (United States). It previously occurred on Laysan also, where the nominate race was estimated to number 1,500 birds in 1915, but became extinct between 1916 and 1923.

It prefers dense cover near the ground, particularly around the shrubs such as *Chenopodium oahuense, Sida fallax* and *Solanum nelsoni*.

Status: Extinct and **Critically Endangered.** **Global Population:** 250-999 Mature individuals with fluctuating trends. Its extinction on Laysan was ultimately caused by the introduction of rabbits, which denuded the island of vegetation (causing severe insect food shortage). On Nihoa, the population size is probably regulated primarily by precipitation levels, which affect the abundance of invertebrate prey (extended droughts for example, are likely to have a negative



impact). Severe weather events such as hurricanes may cause direct mortality of millerbirds; a single severe storm could extinguish the population. Fire is a past and potential threat and introduction of detrimental non-native species is a permanent possibility.

Diet: Small beetles, spiders, roaches and larvae. The extinct Laysan population was thought to have fed primarily on moths.

Breeding: A small reed-warbler that is dark olive and olive brown above with grayish margins on feathers. The wing and rectrices are chaetura drab (nearly neutral slightly olive black that is very slightly darker and more neutral than London smoke). It is whitish below with some grayish olive wash on sides; and buffy brown flanks. The bill is thin and blackish. The feet and legs are dark gray. Sexes are similar, but females tend to be slightly smaller,

Pairs show year-to-year fidelity in specific territories, with nesting apparently correlated with precipitation and most breeding taking place in the winter months (peaking January-March), although the breeding period may be extended in years of high summer rainfall. Nests are located in dense shrubs (*mainly C. oahuense*) and two eggs are generally laid.

Cool Facts: Nihoa is part of the Hawaiian Islands National Wildlife Refuge and Papahanaumokuakea Marine National Monument. Legal access is controlled by a permit system that is restricted largely to biologists, other researchers, and native Hawaiian cultural practitioners. Strict protocols are followed to ensure that legal permittees do not accidentally introduce new species via seeds, eggs or insects travelling on clothes and equipment. Visiting scientists make efforts to control alien plants by hand weeding.

The Nihoa Millerbird and Laysan Millerbird are the only known Old World warblers (subfamily *Sylviinae*) that colonized the Hawaiian Archipelago, the most remote group of islands in the world. The Laysan form, discovered first, was named “millerbird” by Henshaw in 1902 because of its fondness for feeding on large miller moths (probably *Agrotis spp*.).

- *A. f. kingi.* First reported by Palmer and Munro in 1891. The Nihoa Millerbird is found on Nihoa, in western Hawaiian Islands. The Nihoa form is much darker above, and larger than extinct Laysan form.
- *A. f. familiaris.* First reported by Palmer and Munro in 1891. The Laysan Millerbird was found on Laysan, in the northwestern Hawaiian Islands. Tail barring on Laysan Millerbird more noticeable than on Nihoa form.

Hawaiian Name: ‘oma’o
Common Name: ‘oma‘o (Hawaiian Thrush)
Scientific Name: *Myadestes obscurus*

Size: 7-8 inches (18-21cm)

Habitat: Polynesia; found on Hawaii in high elevation forests. The ‘oma‘o occur in mesic and wet montane forests above 1000 meters (3300’) in Hamakua, Ka‘u, and Kilauea districts of the Hawai‘i island.

It occupies ‘öhi‘a and mixed ‘öhi‘a and koa forests. It prefers foraging on tree branches, trunks, and downed logs often covered with moss.

Status: Vulnerable. Global Population: 170,000 mature individuals with a declining population trend. Residents of montane rain forests, the ‘Öma‘o once occupied mesic and wet forest habitats of wide elevational range. However, habitat destruction and the introduction of alien predators and diseases have resulted in large range contractions and, in the case of the ‘Ämaui and Oloma‘o, species extinctions. Remaining populations of the ‘Öma‘o on the island of Hawai‘i,

and the Käma‘o on Kaua‘i, are now restricted primarily to forested areas above 1,000 m elevation. The current range of the ‘Öma‘o comprises <30% of its former range, and since the Käma‘o has not been sighted since the early 1990s, its status remains highly uncertain.

Habitat destruction, introduced predators, and diseases have been implicated as significant factors leading to the decline of native thrushes in Hawai‘i. As a result, current conservation priorities include habitat preservation and restoration, predator control, captive propagation, and reintroduction efforts, with an ultimate goal of stabilizing existing populations and preventing further localized extinctions..

Diet: Primarily fruits and supplemented by invertebrates. Both native and introduced fruits are included in their diets, and the birds forage opportunistically for seasonally available food items. Invertebrate prey items include caterpillars, spiders, beetles, and land snails.

Feeding birds hop along branches when gleaning insects. Females hop on branches and the ground when gathering nest material. Birds in the high-elevation Mauna Loa 'Öma'o population frequently hop on lava formations on the ground. It is not known to walk, run, or climb.

Breeding: A medium-sized thrush. Sexes are alike in plumage but the unflattened wing chord and bill depth are slightly larger in some males.
The adults plumage is drab gray-brown above, with a lighter gray on the breast and flanks. The forehead is gray and there is no eye-ring. The bill and legs are dark. The bill short and broad with bristles at base. The juveniles plumage is browner above, heavily scalloped on the wing- and tail-coverts and the breast. The breast feathers are off-white, tipped with black. The coverts are brown, tipped with buff. Birds, in their second calendar year, are distinguishable from adults in January-May by the variable remnant scalloping on wing coverts and/or tertials.

‘Öma‘o are usually solitary, but individuals can be found in pairs throughout the year, with pair bonds lasting at least one breeding season. Courtship behavior is most often seen between January and March, with most breeding taking place between April and August. Females are responsible for both nest construction and incubation of one or two eggs. The nest are a woven mix of twigs and fiber. Incubation lasts for about 16 days, and the young remain in the nest for about 19 days before fledging. Both sexes feed nestlings, and both adults provide parental care for more than three weeks after young birds leave the nest.

Cool Facts: The `Öma‘o is also known as the Hawaiian thrush and is an accomplished songster. It is found throughout the native windward rainforests of the Island of Hawaii above 3,000 feet.

Hawaiian thrushes are prone to long bouts of silent, motionless perching. The ‘Öma‘o, however, exhibits a unique habit of frequent wing-quivering when perched silently. Although its songs are loud, unique in composition, and produced throughout the year, the sedentary habits of these birds result in observers detecting these thrushes by sound more frequently than by sight.

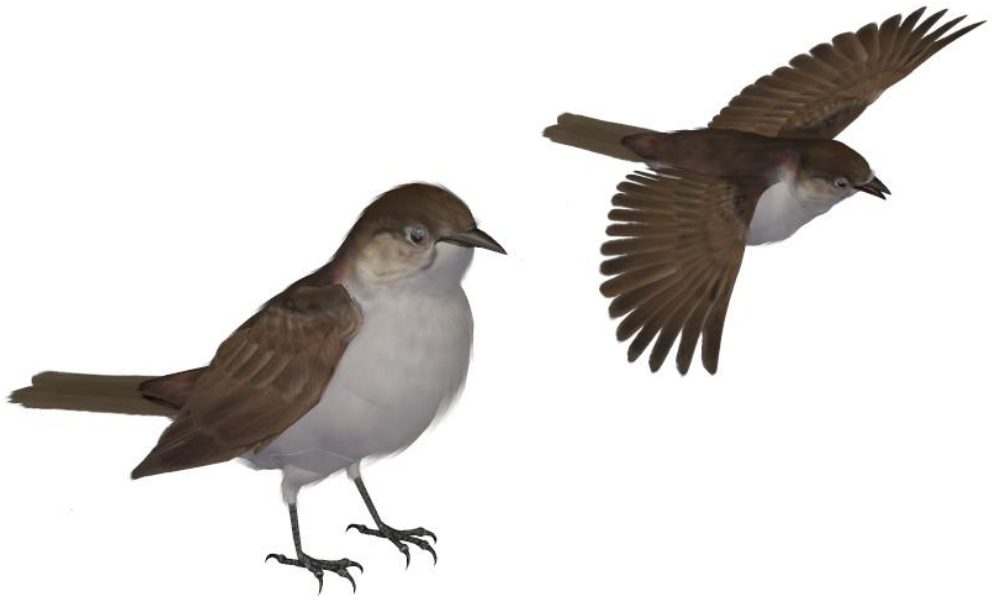
The Hawaiian name, oma’o probably is a corruption from 'Amaui (the name originally given to all the Hawaiian Thrushes) and is formed from the name Manu a Mau'i or "Island Thrush".

Hawaiian Name: kāmaʻo
Common Name: Large Kauaʻi Thrush
Scientific Name: *Myadestes myadestinus*

Size: 8 inches (20 cm)

Habitat: Oceania; endemic to Kaua`i in the Hawaiian Islands (USA). Originally inhabited forest at all elevations, but after the 1920s it was restricted to dense montane forest.

Status: **Extinct (2004)** **Global Population:** 0. It was the most common of the forest birds in 1891 but, by 1928, had disappeared from the lower altitudes and became restricted to dense montane forest in the Alaka`i Wilderness Preserve. During 1968-1973, its population was estimated at 337 while, in 1981, an estimated 24 individuals were present. The last probable sighting was in 1989, and since then there have been several unconfirmed reports but no confirmed detections despite numerous intensive surveys in areas formerly occupied, particularly in 1995 and 1997. It now seems appropriate to reclassify this species as Extinct as there seems little reasonable doubt that the last individual has died. However, it is worth noting that *M. palmeri* went many years without being seen, but then began to reappear in small numbers.



Disease carried by introduced mosquitoes and the destruction and degradation of forests are likely to have been the chief causes of extinction. The advance of feral pigs into pristine upland forests degraded habitat and facilitated the spread of mosquitoes. Competition with introduced birds may have exacerbated the problems faced by this species. Deprived of lowland forest the species was also exposed to the effects of hurricane damage of upland forest, which severely disrupted portions of native forest and allowed the germination and expansion of noxious weeds. Also potentially detrimental to the remaining suitable habitat was the introduction of new alien invertebrates, such as the two-spotted leafhopper, which may have threatened many food plants.

Diet: Mixed diet of fruit, invertebrates, and flower parts. The diet thought to be similar to that of Puaiohi and ʻÖmaʻo, including fruits of ʻölapa, lapalapa, ʻöhiʻa hä, kanawao, ʻöhelo, paʻiniu, thimbleberry, pükiawe, käwaʻu, and pilo. The diet may also include fruits of kölea, mämaki, and

lobelias. Endemic dragonflies and damselflies, weevils, spiders, caterpillars, nematodes), and beetles likely are included in non-fruit portion of its diet.

Breeding: The adult plumage was drab gray-brown above, lighter gray on the breast and flanks. The forehead was gray with no eye-ring. The bill and legs were dark. The bill was short and broad with bristles at the base. The sexes alike in plumage. The juvenile plumage was browner above, heavily scalloped on the wing- and tail-coverts and the breast. The breast feathers were off-white, tipped with black. The coverts were brown, tipped with buff. Birds in their second calendar year are distinguishable from adults in January through May by variable remnant scalloping on the wing coverts and/or tertials. The sexes were similar in size, but an unflattened wing chord and bill depth are slightly larger in some males.

They were usually solitary, but individuals could be found in pairs throughout the year, with pair bonds lasting at least one breeding season.

Courtship behavior was most often seen between January and March, with most breeding taking place between April and August. Females were responsible for both nest construction and incubation of one or two eggs. The nest was a woven mix of twigs and fiber. Incubation lasted for about 16 days, and the young remained in the nest for about 19 days before fledging. Both sexes fed nestlings, and both adults provided parental care for more than three weeks after young birds left the nest.

Typical Hawaiian thrush habitat, Hakalua Forest NWR (Photo: Ken Gilliland)

Cool Facts: Its song was a complex melody composed of flute-like notes, liquid warbles, buzzy trills, and gurgling whistles The call was a raspy "braak," with an alternate high pitched note similar to a police whistle. The bird occurred in the understory of densely vegetated gulches, where it often perched motionlessly in a hunched posture. Like other native Hawaiian thrushes, it often quivered its wings.

Hawaiian Name: olomaʻo
Common Name: Lānaʻi Thrush
Scientific Name: *Myadestes lanaiensis*

Size: 7 inches (18 cm)

Habitat: Oceania; endemic to Mau'i, Lānaʻi and Molokaʻi in the Hawaiian Islands (USA). Originally inhabited forest at all elevations, but since 1920s restricted to dense montane forest.

Status: Extinct (1980). Global Population: Unknown. The last definitive sighting occurred on Molokaʻi in 1980 in the Kamakou Preserve, and in 1933 on Lānaʻi. In the late 19th century, it was considered common to abundant on the three islands, but land clearing, including the establishment and subsequent development of Lānaʻi City, and avian malaria brought on by introduced mosquitoes decimated the birds. Introduced animals such as feral pigs (which create pools from their wallows for breeding mosquitoes) also aided in its demise.

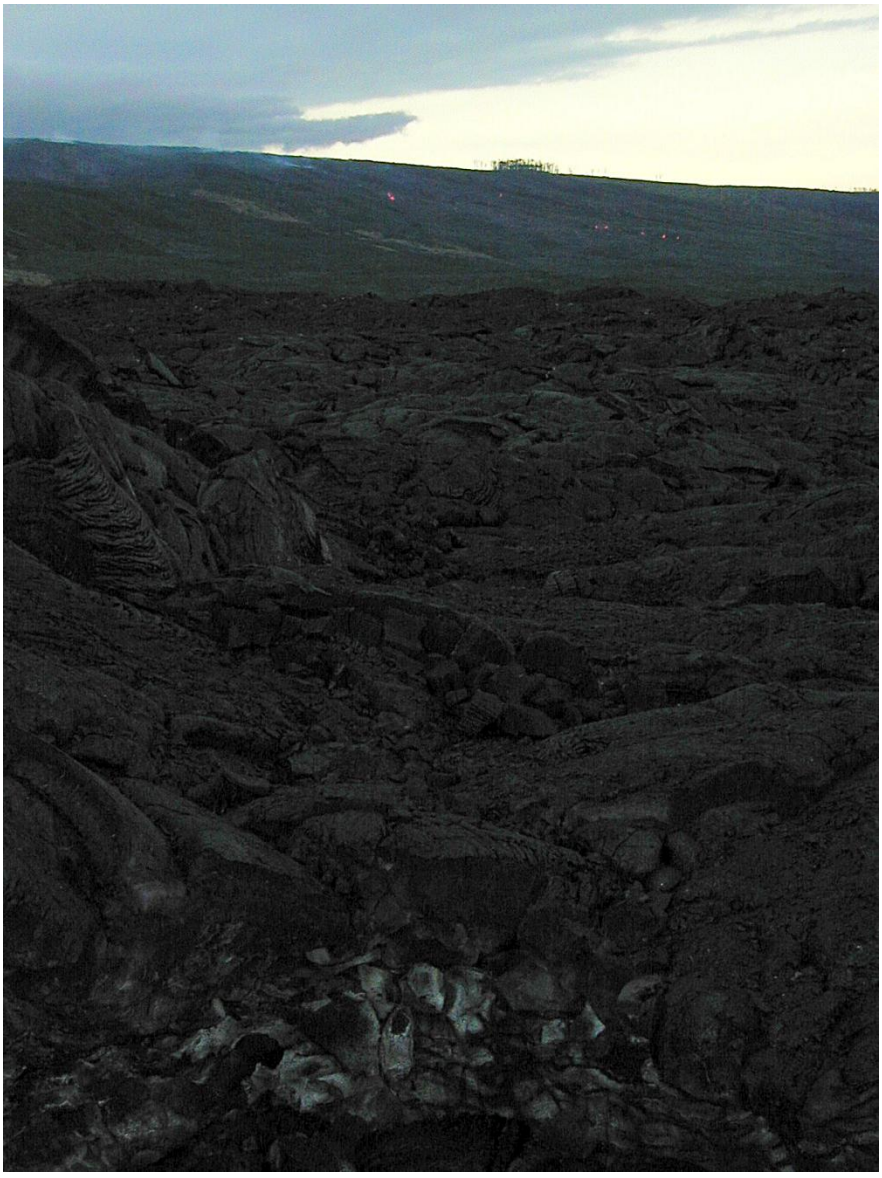
The Kamakou Preserve and neighboring land have been partially fenced and control programs exist for feral ungulates. The Oloku`i Natural Area, established in 1986, protects pristine native forest where *M. lanaiensis* may persist. Should it be rediscovered, consideration should be given to establishing a captive population at high elevation on East Mau'i, where the habitat is relatively intact and free of threat from mosquitoes and avian disease.

Diet: Fruit and insects.

It occurs in densely vegetated gulches, frequenting the understory where it often perches motionless in a hunched posture. Like other native Hawaiian thrushes, it quivers its wings and feeds primarily on fruit and insects.

Breeding: The male and female of the species look similar. They are solitary birds, but individuals can be found in pairs throughout the year, with pair bonds lasting at least one breeding season.

Courtship behavior is most often seen between January and March, with most breeding taking place between April and August. Females are responsible for both nest construction and incubation of one or two eggs. The nest is a woven mix of twigs and fiber. Incubation lasts for about 16 days, and the young remain in the nest for about 19 days before fledging. Both sexes feed nestlings, and both adults provide parental care for more than three weeks after young birds leave the nest.



Lava Flow at Volcano National Park (Photo: Ken Gilliland)

Cool Facts: Its song consists of a complex melody of flute-like notes, liquid warbles, and gurgling whistles. The call is a catlike rasp," with an alternate high pitched note similar to a police whistle. This bird occurs in densely vegetated gulches, frequenting the understory where it often perches motionless in a hunched posture. Like other native Hawaiian thrushes, it quivers its wings and feeds primarily on fruit and insects.

Two subspecies are recognized:

- *M. l. lanaiensis.* First reported by J. F. Gmelin in 1789. The nominate subspecies was known as the Lāna‘i Thrush
- *M. l. rutha.* First reported by J. F. Gmelin in 1789. The Moloka‘i Thrush was also found on Mau’i. Mau’i birds may have constituted a separate subspecies or race, but became extinct before any studies could be performed.

Hawaiian Name: ʻalala
Common Name: ʻalalā (Hawaiian Crow)
Scientific Name: *Corvus hawaiiensis*

Size: 19-20 inches (48-50 cm)

Habitat: Oceania; Hawaiian Islands.

Before the Hawaiian crow became extinct in the wild, the species was found only in the western and southeastern parts of Hawaii. It inhabited dry and mesic forests on the slopes of Mauna Loa and Hualālai at elevations of 3,000 to 6,000 feet. Ōhiʻa lehua (*Metrosideros polymorpha*) and koa (*Acacia koa*) were important tree species in its wild habitat. Extensive under-story cover was necessary to protect the crow from predation by the Hawaiian Hawk, (*Buteo solitarius*). Nesting sites of the ʻalalā received 600–2,500 mm (24–98 in) of annual rainfall. Fossil remains indicate that the Hawaiian crow used to be relatively abundant on all the main islands of Hawaii, along with four other extinct crow species.

Status: **Extinct in the wild.** **Global Population:** 114 mature individuals. The reason of its decline and extinction in the wild is unknown, although avian malaria passed by the non-endemic mosquito is believed to be a contributing factor. Although the ʻalalā survived human colonization of the islands, beginning about 1,600 years ago, it is besieged by formidable threats and is one of the most highly threatened species in the world.

The last two known wild individuals of this species disappeared in 2002. There are some individuals in captive breeding facilities, but attempts to reintroduce captive-bred birds into the wild have been hampered by predation by the Hawaiian hawk or ʻIo (which is also endangered). While some scientists believe that the small number of remaining individuals may be too small to offer a diverse gene pool, the San Diego Zoological Society's breeding program produced 11 new fledglings in 2010 giving this species hope to survive.

Activity within the captive flock has been relatively low and unreliable since ʻalalā were first captured for captive propagation in 1973. Of 27 ʻalalā released to the wild during 1993–1999, 21 disappeared or died mainly because of diseases, predation by ʻIo, and possibly poor nutrition (USFWS). None produced eggs, although many survived to sexual maturity and two 4-yr-olds paired and constructed nests. The 6 surviving ʻalalā were captured in 1999 and have been held with other captive-reared birds for protection and breeding until limiting factors in the wild can be reduced.

There have been attempts to reintroduce the ʻalalā to the forests since 2016. Out of the 30 birds released, only these five had survived. The five birds were recaptured, one of those is named Kiaʻikūmokuhāliʻi (Guardian of the Forest). In the days before his recapture, researchers could hear Kiaʻikūmokuhāliʻi making alarm calls as an ʻIo (Hawaiian Hawk) was seen circling the area. But he stood his ground quite well.

"We call him the 'champion bird,'" project coordinator Jackie Guadioso-Levita says, citing his survival skills. "He can be aggressive and has been seen mobbing ʻIo."

"These five birds can serve as really valuable mentors," she says. "We want to make sure that their skills and wild culture can be passed on to future release birds."

Since the captive ʻalalā have been given a more natural diet, the birds have started engaging in courtship behaviors and formed multiple breeding pairs, many of which went on to display preliminary nest-building efforts (though only one pair successfully completed a nest).

Most of the mated pairs chose to make their nest attempts in the ʻŌhiʻa tree, a native flowering evergreen preferred by breeding ʻAlalā. Unfortunately for the project, the species' reliance on these trees adds a layer of complexity to the reintroduction effort. The ʻŌhiʻa is threatened by an invasive fungal species that swiftly kills the trees, which make up a large portion of Hawaii's forests.

Such complications are what make any reintroduction difficult, and though the crows have shown encouraging progress, the researchers are aware of how fragile the situation remains. Next up in the plans is to release birds in areas other than the Puʻu Makaʻala Natural Area Reserve and to continue spreading awareness to local communities about the importance of restoring ʻAlalā to their natural habitat.

"It's really important to keep in mind that it takes many years to establish a species back to the wild," says Gaudioso-Levita. "We're all in it for the long haul."

Diet: A varied diet, including carrion, eggs and nestlings, other small creatures, fruits, and even human food and scraps. The main portion of their diet, and 50% of their feeding activity is spent foraging on trunks, branches, and foliage for invertebrates such as isopods, land snails, and

arachnids. They feed in a woodpecker fashion, flaking bark and moss from trunks or branches to expose hidden insects, foraging mostly on ohia and koa, the tallest and most dominant trees in their habitats. Fruits are the second most dominant component in the Hawaiian crow's diet. The crows often collect kepau and olapa fruit clusters. Although hoawa and alani fruits have hard outer coverings, crows continue to exert energy prying them open. Passerine nestlings and eggs are consumed most frequently in April and May, during their breeding season. Other prey include red-billed leiothrix, Japanese white-eye, Hawai‘i ‘amakihi, ‘I‘iwi, ‘elepaio, and ‘apapane. The ‘alalā also commonly forages on flowers, especially from February through May. Nectar to feed the young are obtained from the ohia flower, oha kepau, and purple poka during the nestling period. Crows also foraged various plant parts, including the flower petals of kolea, koa, and mamane. The palila is the only other Hawaiian bird known to eat flower petals. The ‘alalā only occasionally forages on the ground, but only for a limited amount of time for risk of predators.

Captive individuals can use sticks as tools to extract food from holes drilled in logs. The juveniles exhibit tool use without training or social learning from adults, and it is believed to be a species-wide ability.

Nesting: It is similar to a carrion crow but with more rounded wings and a much thicker bill. It has soft, brownish-black plumage and long, bristly throat feathers; the feet, legs and bill are black.

Female crows are considered sexually mature at about 2 or 3 years of age and males at 4 years. The Hawaiian crow's breeding season lasts from March to July; it builds a nest in March or April, lays eggs in mid-to-late April, and the eggs hatch in mid-May. Both sexes construct nests with branches from the native ohi’a tree strengthened with grasses. The crow typically lays one to five eggs (that are greenish-blue in color) per season, although at most only two will survive past the fledgling phase. Only the females incubate the 2–5 eggs for 19–22 days and brood the young, of which only 1–2 fledge about 40 days after hatching. If the first clutch is lost, the pair will re-lay, which serves to be helpful in captive breeding efforts. Juveniles rely on their parents for 8 months and will stay with the family group until the next breeding season

Cool Facts: The ‘alalā was one of the largest native bird populations in Hawaii. Its disappearance in the wild has had cascading effects on the environment, especially with the seed dispersal of the native plants. Many of these plants rely on the ‘alalā not only for seed dispersal, but also for seed germination as seeds are passed through the crow's digestive system. Without seed dispersal, the plants have no means of growing another generation. The ‘alalā plays a key role in the maintenance of many indigenous plant species, which now could become a rarity in Hawaii's ecosystems, specifically the dry forests, without their main seed disperser. The Hawaiian crow has become known as an indicator species; the disappearance of the ‘alalā indicates serious environmental problems.

‘Alala means to cry, crow or caw. Also 'Ala means to rise and la means the sun and refers to the flocks of birds which would start calling noisily at dawn.

Hawaiian Name: palila
Common Name: Palila
Scientific Name: *Loxioides bailleu*

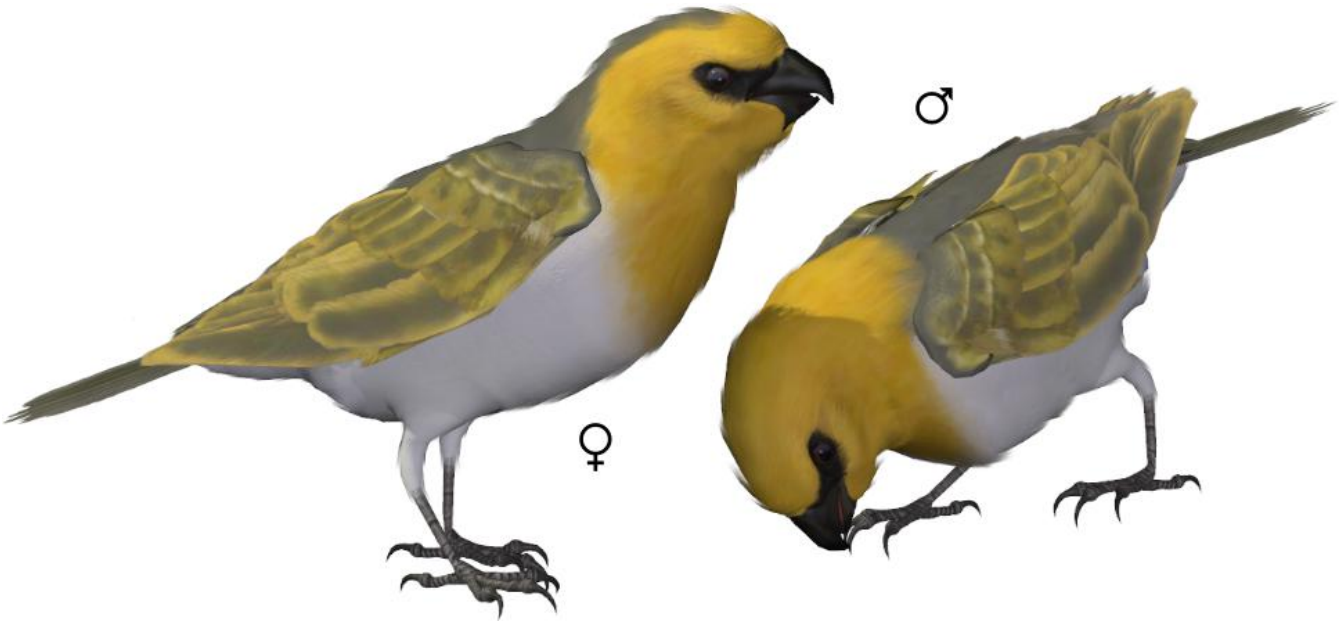
Size: 7.5 inches (19 cm)

Habitat: Oceania; endemic to the slopes of Mauna Kea on Hawai'i.

It is only found in mämane forests above the mosquito line.

Status: Critically Endangered. **Global Population:** 1000-2499 mature individuals with a decreasing population trend. It is endangered because its main source of food, the mämane tree is also threatened. Cattle from nearby ranches trample the root systems of the trees and thereby, killing them.

Encroaching development also plays a role. In the mid-90's the remaining Palila population was moved to the base of Mauna Kea where a 100 acre grove of mämane trees still remained and was fenced off from cattle grazing. Unfortunately, invasive weeds and extremely flammable fountain grass surround the entire area. One wildfire could bring this bird to extinction and this author noted in a recent trip, numerous cigarettes butts were found scattered in the brush of its habitat.



Like most *drepanidines,* the Palila produces small clutches, usually only 2 eggs. However, Palila embryos and chicks develop slowly, so eggs and nestlings are threatened by storms and predators for a longer time than many other small passerine species.

Diet: The bulk of their diet is mämane seeds. . In addition to seeds, small developing mämane pods sometimes eaten whole without the seeds being extracted. Mämane flower buds and reproductive parts (particularly anthers) are important foods, especially when seeds are less

available. Naio fruit also frequently eaten when mämane foods are less abundant. *Lepidoptera* larvae are important to nestlings, but are also eaten year-round by adults and other age groups.

The Palila generally prefers large mämane trees but is highly selective with regard to individual trees in which it forages, nests, and roosts. Populations thrive in large tracts of forest arrayed along a gradient of elevation. Mämane flower and seed availability varies annually among trees, but the timing of production is strongly influenced by elevation. Thus, food resources are available year-round in forest tracts that extend broadly down and around mountain slopes, and small, loose flocks of these social birds track the availability of mämane pods up and down steep, volcanic slopes. However, in contrast to nectar-seeking birds that seasonally invade mämane forests, Palila are relatively sedentary and tend not to travel more than a few kilometers from their natal nests.

Breeding: It is a sexually dimorphic finch with yellow head and breast, gray back, white belly, greenish wings and tail, and black conical bill. The pale-gray rump noticeable in flight. Body characters similar in both sexes and all age classes. Distinct line separating gray color on back from yellow color on head distinguishes male from female. Separation between these colors on upper-parts of female indistinct, with varying amounts of gray feathers mixing with yellow feathers at the nape. Presence of complete or partial wing-bars on median and greater wing coverts distinguishes juveniles from adults. The bills of nestlings are yellow. The yellow tip fades to white in fledglings and the bill is entirely black in adults. The legs are black and the iris is dark brown in all Palila.

They nest in mämane trees. The first clutches are laid during February through July, depending on availability of mämane pods. The female selects the nest site. She also builds the nest with some contributions from the male.The composition of the nest base varies from entirely small, dead sticks, which are collected from nest tree. The cup is lined with lichens (*Usnea sp.*), fine grasses, and rootlets.

This species exhibits low rates of reproduction, laying fewer eggs and taking longer to raise its young compared with mainland songbirds.

Cool Facts: The Palila is one of the last surviving of the extraordinary “finch-billed” Hawaiian honeycreepers (*Drepanidinae*) and lives the big Island of Hawaii.

The Palila is the largest of the Hawaiian honeycreepers and is probably the most studied.

Although the Palila has been known to eat some insects and naio berries, its primary diet comes from the Mämane tree. It eats seeds from its green pods, the flower petals and even the young leaves. The population numbers for the Palila are in direct proportion with the success of the Mämane’s blooming season.

Hawaiian Name: ʻākepa
Common Name: ʻ Akepa
Scientific Name: *Loxops coccineus*

Size: 4 inches (10 cm)

Habitat: Oceania; Hawaiian Islands. Found on the island of Hawai'i, Mau'i and Kaua`i. Fossil evidence shows it was once found in O'ahu as well.

It is found most commonly in ʻOhi'a-lehua and Koa-`Ohi`a forests above 3,000 feet.

Status: Endangered. Global Population: 9,300 mature individuals with a declining population trend. Once found throughout Hawai'i in suitable habitat, but by 1980s occupied only 10% of former range. Currently, it has fragmented distribution above 1100 m, with three largest segments on windward eastern slope of Mauna Kea, on eastern flank of Mauna Loa, and in Kaʻu Forest Reserve (on southern flank of Mauna Loa); also, two tiny relict populations in central Kona (western slope of Mauna Loa) and one on northern slope of Hualalai Volcano.

The total population at end of 20th century was estimated at about 14,000. At Hakalau Forest National Wildlife Refuge, a University of Hawaii team claims a huge population crash has occurred since 2000, caused by introduced organisms, particularly Japanese White-eyes (*Zosterops japonicus*), that have depleted akepa food supplies and thereby reduced nesting success and fledgling survival, and biased the sex ratio so that males far outnumber females in some age classes. Studies by refuge biologists and others have not been able to corroborate these findings, and have found no drastic declines since 2000 and no negative correlation with white-eye populations or indications of food competition with them. Independent panel in 2008 concluded that management of feral ungulates was a higher priority than management of white-eyes in the wildlife refuge. As in other Hawaiian forest bird species, distribution may be restricted by presence of malaria-carrying mosquitoes (*Culicidae*) at lower elevations; rising global temperatures, allowing mosquitoes to spread into higher elevations, may therefore pose a significant threat; a model predicts that under a likely scenario of continued disease-driven distribution limitation this species will lose c. 90% of its range by 2100.

Diet: Feeds extensively on small insects, spiders, and caterpillars. It very rarely appears to feed on nectar, but may instead be searching flowers for insects.

Nesting: A very small finch-like passerine with a conical bill. The tips of mandibles slightly crossed, mainly by deflection of upper mandible to right or left (roughly equal proportions). The male is a brilliant red-orange or vermilion, including on the shoulder. The primaries, secondaries and their coverts and tail feathers are contrastingly brownish-black, narrowly edged red on the outer webs. The iris very dark brown (appearing black) and the orbital ring is black. The bill is pale gray to straw-yellow, sometimes with dark tip. The legs are black with the toe pads more grayish. Females are dark gray-green above and much paler below, with a pale face and diffuse supercilium, and broad pale yellowish-orange breast band. Juveniles of both sexes are olive-gray above, pale cream or off-white below and on face and supercilium. They have darker wing feathers edged olive-gray and the bill is brownish-gray. Second-year malea are orange-brown above, irregularly blotchy dull orange, yellow and vermilion below and the bill becoming irregularly lighter. Males reaches adult plumage in three years.

'Akepas on Hawai'i nest only in cavities in large, old-growth 'Ohi'a and Koa trees. Since no Hawaiian birds are known to excavate tree cavities, 'Akepas are dependent on naturally occurring cavities for nesting sites. Females are solely responsible for nest construction, which is unusual among the insectivorous and nectarivorous members of the Hawaiian honeycreepers group. Typical clutches have only one or two eggs, which results in an unusually low annual reproductive output for a small songbird. Another interesting aspect of 'Akepas' breeding behavior is that males perform large, lek-like group displays, despite the fact that 'Akepas are monogamous birds that form long-term pair bonds. Since this species is an obligate tree cavity nester, the logging of old, mature trees has eliminated potential nesting sites and decreased available foraging habitat.

Cool Facts: ‘Akepa in Hawaiian means nimble or quick. `Akepa is also known as `Akakane, and the Mau'i `Akepa as `Akepeu`ie. They use their bills to pry open `ohi`a buds, small seed pods, and galls in search of food. They have been known to drink nectar from `ohi`a and other flowers. Their "kee-wit" calls are quiet and their songs are a short, warbling trill.

The Mau’i and Hawai`i `Akepa were listed as an endangered species on October 13, 1970. A large population of 'Akepas on Hawaii is protected at the Hakalau Forest NWR, which was created in 1985 to protect native Hawaiian forest birds and their habitats. A threatened population of these birds is protected by the Pu'u Wa'awa'a State Wildlife Preserve on northern Hualalai. 'Akepas also receive lesser protection at the Ka'u Forest Reserve, Kulani Prison, and Kilauea-Keauhou forests. Current conservation efforts on Hawaii include the introduction of artificial nest cavities at Hakalau Forest NWR. While only one artificial cavity (out of 69) has been used by 'Akepas, that one cavity was used successfully by a pair two years in a row.

While the reasons for the decline of 'Akepas on Mau’i are not understood, conservation efforts on that island have included the virtual elimination of feral pigs from important natural areas, as well as attempts to control rat populations. Despite these efforts, Mau’i 'Akepas have continued to decline, and may well be extinct.

The Hawaiian word ‘ākepa means “Active”, “Nimble” or “Quick”.

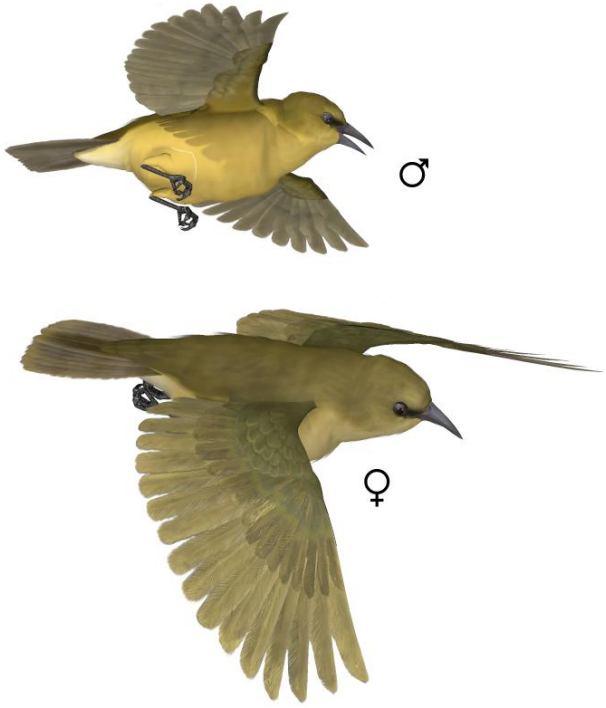
Ohia and Koa trees at Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

Hawaiian Name: ‘amakihi
Common Name: Common ‘amakihi
Scientific Name: *Chlorodrepanis virens*

Size: 4.5 inches (11 cm)

Habitat: Oceania; Hawaiian Islands. One of the most common native birds, found on all main islands, except Lana`i where it is now likely extinct. Inhabits a variety of native habitats from sea level to the shrub lands of the islands' highest volcanoes (around 8000 feet), and is occasionally seen among introduced vegetation.

Status: Not threatened. **Global Population:** unknown. Of all the native forest birds, `Amakihi may be least affected by changes in habitat that have resulted from human activities. Amakihi are one of the very few native birds that may be evolving resistance to introduced diseases such as avian malaria and avian poxvirus. `Amakihi are seen with increasing frequency in suburban areas of O`ahu, including Aina Haina, Manoa, and Nuuanu.



Diet: `Amakihi have a very wide diet. They possess a tubular tongue that is characteristic of nectar-feeding species, and use it to obtain nectar from a variety of native flowers such as `ohi`a-lehua, akala (Hawaiian raspberry), and mamane, as well as many introduced species. Amakihi also hunt a variety of insect and spider species which they glean from the foliage and bark of trees and shrubs, and are known to occasionally suck the juices from a variety of fruits.

Breeding: yellow green honeycreeper with blackish lores and short decurved bill. Adult male has bright yellow green upperparts and yellowish underparts. Interisland plumage variation of males is slight, differing primarily in amount of yellow on underparts. Adult male is yellower and has longer bill than female or immature. On Mau'i and Moloka‘i Is., female dull grayish green, but on Hawai‘i I. greener. Immature is dull grayish green, with pale wing-bars and gray lores. Some immatures on Mauna Kea, Hawai‘i I., have gray plumage (U.S. Geological Survey [USGS] unpubl.).

Hawai‘i ‘Amakihi could be confused with Hawai‘i Creeper (Oreomystis mana), but bill of Hawai‘i Creeper is only slightly decurved, and adults have white throats that contrast with greenish tones of breast and dark eye-patch (Scott et al. 1979). The broad black or dark gray eye-patch that extends behind the eye on Hawai‘i Creeper is also useful in distinguishing it from Hawai‘i ‘Amakihi, whose black or gray lore does not extend behind the eye (Scott et al. 1979). On Mau'i I., confusion between Hawai‘i ‘Amakihi and Mau'i ‘Alauahio (Paroreomyza montana) also possible, especially for females and immatures, but Mau'i ‘Alauahio has short, straight bill and

lacks the prominent black lores. On Mau'i I., the extremely rare Nukupu‘u (Hemignathus lucidus) and, on Hawai‘i I., the localized ‘Akiapōlā‘au (H. munroi) are similar to Hawai‘i ‘Amakihi, especially females and immatures, but are slightly larger and have very distinctive long, curved upper mandibles. Songs, calls, and foraging behavior are useful in distinguishing all species (Pratt 1979c, Scott et al. 1979, Shallenberger and Pratt 1978, Pratt et al. 1987). Like most other drepanids, ‘amakihi have strong musky odor (Perkins 1903).

The breeding seasons vary depending on the island. Both male and female take part in building the nest, which is made of fine grasses and lichens. The clutch varies from two to four eggs. Incubation period is 14 days, nestling period is 17-20 days.

Cool Facts: Until 1995, the Hawai‘i, Kaua‘i, and O‘ahu ‘amakihi were considered subspecies under the superspecies Common ‘Amakihi (*Hemignathus virens*). `Amakihi are members of the endemic subfamily of Hawaiian honeycreepers (Drepanidinae), which are among the world's most famous and spectacular examples of adaptive radiation evolution of a variety of species from a single common ancestor. `Amakihi are often confused with Japanese white-eyes (or mejiro), but can be distinguished by their black lores and distinctive song and calls.

'Amakihi means "curved" from the words *kihi* or *kihikihi*.

Typical Amakihi habitat at Volcano National Park in Hawai’i (Photo: Ken Gilliland)

Hawaiian Name: ‘akiapola’au
Common Name: ‘Akiapola’au
Scientific Name: *Hemignathus wilsoni*

Size: 6 inches (14 cm)

Habitat: Oceania; endemic to the Big Island of Hawai’I.

The ‘akiapōlā‘au occurs mainly in old-growth mesic and wet forests in Ka‘ū and Hamakua. Koa (*Acacia koa*) and ‘ōhi‘a lehua (*Metrosideros polymorpha*) are dominant canopy species in its habitat. Disease-carrying mosquitoes have restricted it to elevations of between 1,300 and 2,100 m (4,300 and 6,900 ft). It formerly inhabited māmane (*Sophora chrysophylla*) -naio (*Myoporum sandwicense*) dry forests at elevations of 1,900 to 2,900 m (6,200 to 9,500 ft) on Mauna Kea, but this population was extirpated in 2002

Status: Endangered. **Global Population:** 910 mature individuals with a decreasing tend. Its declines started in 1900 with the development of Hawaii. It also suffers from the fate of many native Hawaiian birds; no resistance to avian malaria. Mosquitoes are an introduced insect to the Hawaiian Islands and now virtually none of the native Hawaiian birds live below the 1500' level (the mosquito line).

Preservation efforts have helped slow the rapid decline of this bird. In 1992, the population was estimated at 1,500 and has continued to lose 30% of its population since the first printing of this manual. The Hakalau National Forest Preserve was established to help protect this and other endangered Hawaiian birds.

Diet: Insects which are found hidden within the branches of the trees, along with the nectar of flowers shaped like its bill. It also looks for invertebrates at the floor of the forest where there is a large amount of natural growth. This bird uses its long bill to peck open the bark to reach the larvae; it then uses its thin upper bill to probe out the meal and its lower bill to crush its meal.

Breeding: This species is sexually dimorphic. A mid-sized honeycreeper with an upper mandible long and decurved; the lower mandible short and straight, with gonys roughly half as long as culmen. Males have upper parts yellowish green, face and under parts yellow, and lores black. Females and young variable but upper parts are generally olive-green and under parts are pale grayish yellow, with or without dull yellow on the throat. It differs from Nukupuʻu by the lower mandible, which is straight rather than decurved, by larger size, and by proportionately shorter tail. Distinguishable from Hawaiʻi ʻAmakihi (*Hemignathus virens*) by the much longer bill, larger size, and in males by the more orangish yellow face and under parts. The adult ʻAkiapöläʻau sometimes has a lion-headed look created by holding the feathers of the head fluffed out.

The nest Structure remarkable for its “picket fence” of bark around the rim, which is unique among honeycreeper nests. Females break off twigs and collect bark strips. Males do not participate but are nearby. Materials are gathered 8–35 m away from nest. “Twenty-one trips to the nest were made by the female as she carried bark strips in lengths ranging from 15 to 30 cm.” The female obtained hanging bark strips by “grasping the bark with her bill, and jerking her head back quickly” and partially loose bark by “placing her lower, stouter mandible under the bark and prying upward.” Bark obtained was from both the trunk and limbs of Koa trees. These materials incorporated into exterior wall of nest. Older Koa trees are excavated for nesting cavity.

Cool Facts: The ʻAkiapola’au is found around the base of Mauna Kea, Hawaii. It lives in ancient Koa tree forests where its primary nesting areas and food sources are found. Older Koa trees are excavated for nesting cavity. Insects and beetle larvae are the main food source for the bird as creeps down tree limbs in the forest canopy. It has an unusual bill. The lower bill is shorter than the top— it’s a specialized beak than allows the bird to hammer and drill into the wood with the lower “woodpecker-like” bill and then spear insects with the top portion of the beak.

The ʻAkiapola’au was also known as Nukupu’u (a similar bird) in early Hawaiian literature.

It is the only member of the subgenus Heterorhynchus, which has a woodpecker-like feeding habitat and exclusively preys on insects, in contrast to the nukupu'us, which were both insect-eaters and also hummingbird-like nectarivores.

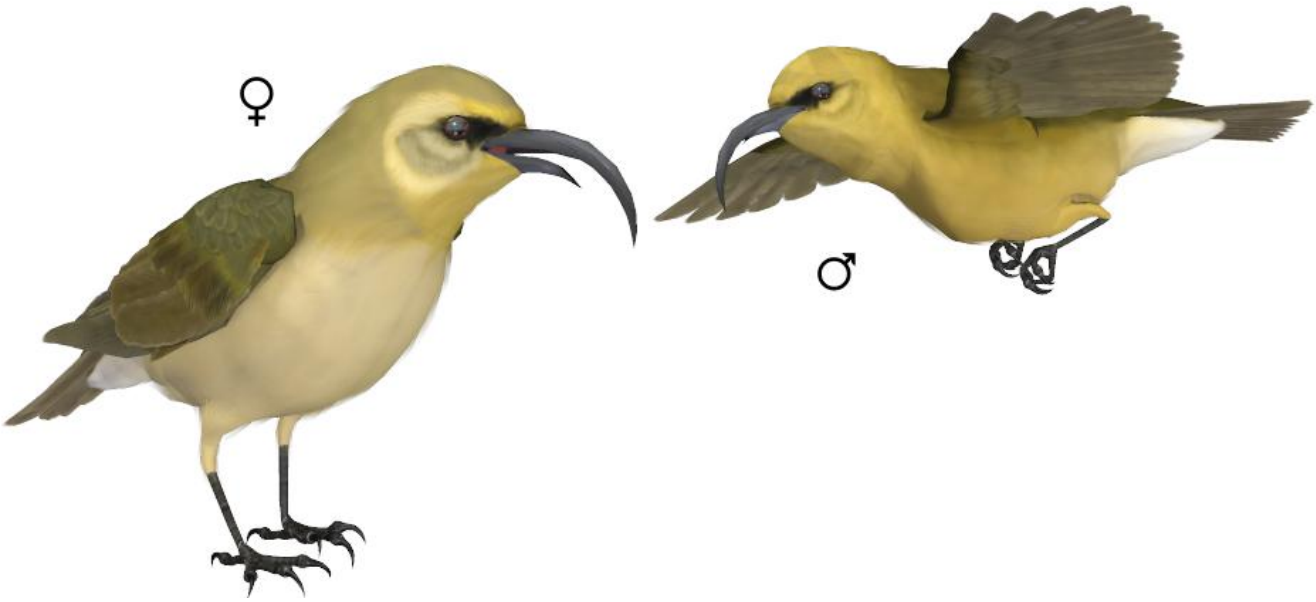
Hawaiian Name: ‘nuku pu’u
Common Name: Kaua’i Nukupu’u
Scientific Name: *Hemignathus hanapepe*

Size: 5.5 inches (14 cm)

Habitat: Oceania; endemic to Kaua‘I (Hawaiian Islands, United States).

It occupied a wide range of forest and shrubland communities. Historically, it inhabited closed ‘Ohi‘a and Koa/‘Ohi‘a montane mesic forests dominated by koa and ‘ōhi‘a-lehua tree species.

Status: Extinct (2021). **Global Population:** 0 mature individuals. The last sightings - both on Kaua‘i and Mau'i - were in 1998, though it is possible some of the sighting in the 1990s actually involve the Kaua‘i ‘Amakihi. Later sightings remain unconfirmed. Recent surveys have failed to locate the species and the United States Fish and Wildlife Service concluded that it in all probability is extinct or functionally extinct. BirdLife International (and thereby IUCN) have chosen to retain its status as critically endangered until additional surveys have confirmed its extinction beyond reasonable doubts. As with several other Hawaiian honeycreepers, the decline of the nuku pu‘u is connected to habitat loss (both due to man and hurricanes), introduced predators and disease-carrying mosquitoes.



Diet: Mainly insects and spiders; very rarely take flower nectar. Often joins mixed species foraging flocks. Apparently would creep along large ‘ōhi‘a (*Metrosideros polymorpha*) limbs searching epiphytes, moss, bark, and dead wood for arthropod prey; may also have taken nectar. Hammered bark with lower mandible, similar to its congener the ‘akiapōlā‘au (*H. munroi*), and used its upper mandible to fish out prey from excavations.

Breeding: It was a mid-sized honeycreeper (estimated 27 g, based on proportional difference in wing chord with ‘Akiapölä‘au). The upper mandible long and decurved with the lower mandible

short and decurved (with the gonys roughly half as long as culmen). Males had upper parts a yellowish-green color with the head, throat, and breast a bright orangish-yellow The belly was whiteand the lores black. Females and young males had upper parts a greenish-gray to gray cast with all under parts whitish (some birds with yellow above the lores, on the chin, or both).

Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

Older Koa trees were excavated for nesting cavity.

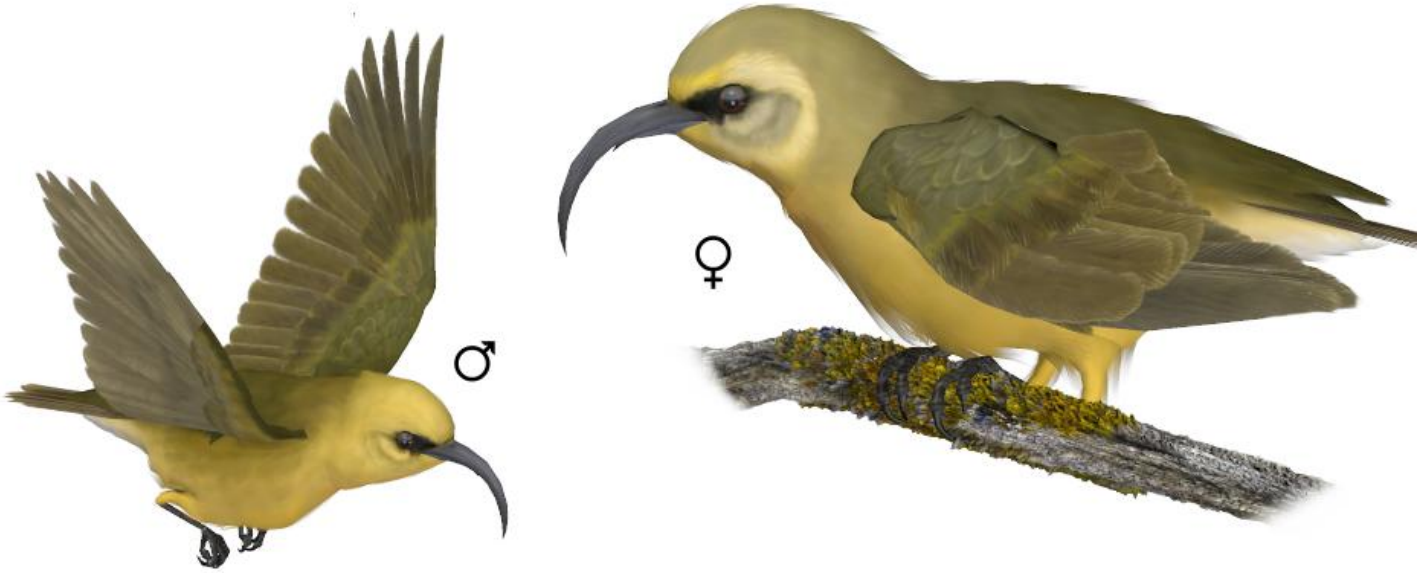
Cool Facts: It was distinguishable from Kaua‘i ‘Amakihi (*Hemignathus kauaiensis*) mainly by color, but also by the much longer bill and larger size. The male Kaua‘i Nukupu‘u differs from Kaua‘i ‘Amakihi by its head color being bright, orangish-yellow rather than greenish-yellow and the lores being black rather than gray. Female and young Kaua‘i Nukupu‘u differ from Kaua‘i ‘Amakihi by the upper parts being more gray than green and the under parts being whitish rather than obviously yellowish cast of the ‘amakihi.

Hawaiian Name: ‘nuku pu’u
Common Name: Mau’i Nukupu’u
Scientific Name: *Hemignathus affinis*

Size: 4.9 inches (12.5 cm)

Habitat: Oceania; endemic to eastern Mau’i, where it is dependent on high-elevation mesic and wet forests of ‘ōhi‘a lehua (*Metrosideros polymorpha*) and koa (*Acacia koa*).

Status: Extinct (2021). **Global Population:** 0 mature individuals. The last sightings - both on Kaua‘i and Mau'i - were in 1998, though it is possible some of the sighting in the 1990s actually involve the Kaua‘i ‘Amakihi. Later sightings remain unconfirmed. Recent surveys have failed to locate the species and the United States Fish and Wildlife Service concluded that it in all probability is extinct or functionally extinct. BirdLife International (and thereby IUCN) have chosen to retain its status as critically endangered until additional surveys have confirmed its extinction beyond reasonable doubts. As with several other Hawaiian honeycreepers, the decline of the nuku pu‘u is connected to habitat loss (both due to man and hurricanes), introduced predators and disease-carrying mosquitoes.



The nukupu‘u is one of the species a project of the East Mau'i Watershed has been aimed at. Other birds from this area included the ‘Ō‘ū and the Po‘ouli. The project involved fencing in the area and eradicating introduced predators. The entire project took out 22 feral cats, 209 pigs, 1,596 Polynesian rats, 1,205 black rats, and 1,948 common mice. On Kaua‘i, comparable projects exist around the Koai‘e Stream.

Sadly, none of these measures were put in place early enough to make a difference and the ‘nuku pu’u, ‘Ō‘ū and Po’oli are all now extinct.

Diet: Insects and beetle larvae. Often joins mixed species foraging flocks. Apparently would creep along large ʻōhiʻa (*Metrosideros polymorpha*) limbs searching epiphytes, moss, bark, and dead wood for arthropod prey; may also have taken nectar. Hammered bark with lower mandible, similar to its congener the ʻakiapōlāʻau (*H. munroi*), and used its upper mandible to fish out prey from excavations.

Breeding: The smallest of the Nukupu'us (estimated mass 23 g). Its bill is the same as for Kauaʻi Nukupuʻu, but shorter. Males had their upper parts olive-green, with the head and chin to breast a bright orangish-yellow, and lores black. Females and young males had their upper parts olive-green and under parts sulfur. It differs from the other species of Nukupuʻu in its smaller body size (virtually no overlap) and flanks that are generally more olive.

Older Koa trees are excavated for nesting cavity.

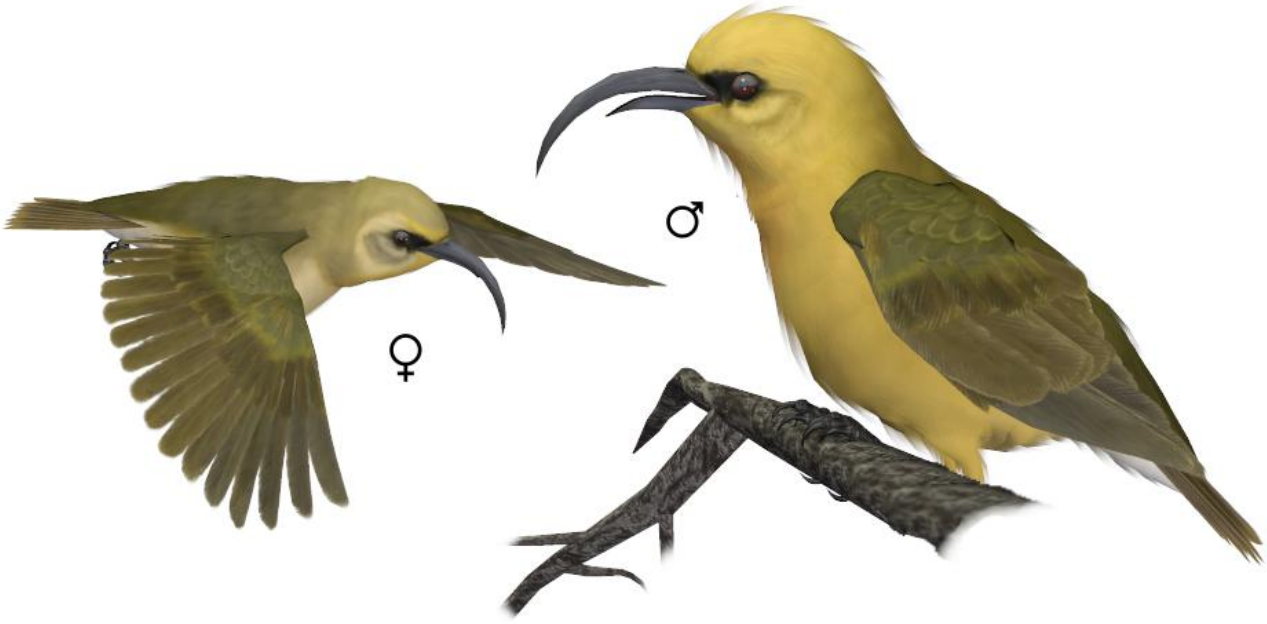
Cool Facts: Males differ from male Kauaʻi Nukupuʻu in that the yellow on the head usually stops at the back of the crown rather than on the forward margin of the back, and the back is more olive. Females and young males differ from Kauaʻi Nukupuʻu in that the yellow superciliary stripe extends completely over and beyond the eye. The back is more olive, the under parts are yellower, and the flanks are more olive.

Hawaiian Name: ‘nuku pu’u
Common Name: O’ahu Nukupu’u
Scientific Name: *Hemignathus lucidus*

Size: 5.7 inches (14.5 cm)

Habitat: Oceania; endemic to Oah’u, eastern Mau'i, where it is dependent on high-elevation mesic and wet forests of ‘ōhi‘a lehua (*Metrosideros polymorpha*) and koa (*Acacia koa*).

Status: Extinct (1841). Global Population: 0 mature individuals. Of the last known specimens recorded of the O‘ahu nukupu‘u, about nine specimens were collected in 1837 by naturalist Ferdinand Deppe and ornithologist John Kirk Townsend. A few more specimens were collected through 1841, and after an extensive search by ornithologist Robert Cyril Layton Perkins, the O‘ahu nukupu‘u was considered extinct since at the start of the 21st century.



The species was believed to have vanished as the spread of disease occurred, killing off nukupu‘u populations across the islands. In order to control the rat population in the sugar cane fields, mongooses were introduced to Hawaii and were suspected to be predators that stole nukupu‘u chicks from nests, furthering the decrease in nukupu‘u population.

Diet: Insects and beetle larvae. Often joins mixed species foraging flocks. Apparently would creep along large ‘ōhi‘a (*Metrosideros polymorpha*) limbs searching epiphytes, moss, bark, and dead wood for arthropod prey; may also have taken nectar. Hammered bark with lower mandible, similar to its congener the ‘akiapōlā‘au (*H. munroi*), and used its upper mandible to fish out prey from excavations.

Breeding: It is a mid-sized honeycreeper (estimated 25 g, based on proportional difference in wing chord with ‘Akiapölä‘au). The bill is the same as for Kaua‘i Nukupu‘u, but proportionately longer. Males had their upper parts an olive-green color. Their foreheads, superciliary stripes,

and chins to breasts were an orangish-yellow with black lores. The females and young males were indistinguishable by color from Kauaʻi Nukupuʻu.

Older Koa trees are excavated for nesting cavity.

Cool Facts: This form very similar in size and coloration to allopatric Kauaʻi Nukupuʻu, except that the males have crown olive-green rather than greenish yellow. Distinguishable from sympatric Oʻahu ʻAmakihi (*Hemignathus flavus*) by the much longer bill, larger size, and in males, by the sides of face and throat bright, orangish-yellow and lores black, and in females and young birds, by the absence of distinct wing-bars.

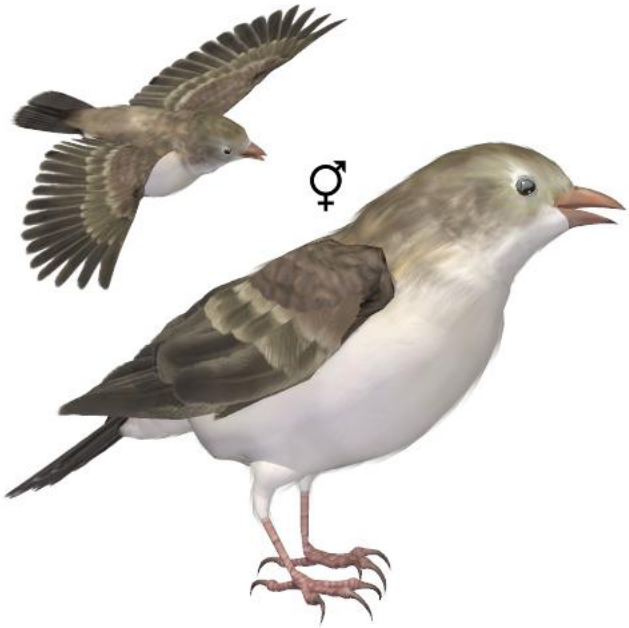
Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

Hawaiian Name: ‘akikiki
Common Name: Kaua’i Creeper
Scientific Name: *Oreomystis bairdi*

Size: 5.75 inches (13cm)

Habitat: Oceania; endemic to Kaua’i. Found only in wet montane forests in central Kauai where it now occupies less than 10% of its former range.

Status: **Critically Endangered.** **Global Population:** 780 - 1,840 mature individuals. The population has declined dramatically since the 1960s and this trend appears to be continuing owing to a number of threatening processes. Consequently, the population is estimated to be declining very rapidly.



Lowland forests have been cleared for timber and agriculture, with feral livestock causing further degradation and destruction. Feral pigs continue to be particularly detrimental, additionally dispersing alien plants and facilitating the spread of introduced mosquitoes which transmit avian malaria and avian pox. Domestic and introduced birds provide reservoirs for these diseases, to which there is little resistance in Hawaiian honeycreeper populations. Predation by introduced animals and competition for arthropod resources by introduced taxa (especially Japanese White-eye (*Zosterops japonicus)*, wasps and ants) are additional threats. Introduced plants such as Kahili ginger, blackberry, strawberry guava, Australian tree fern and firetree have degraded much native forest in Koke'e, and threaten the remaining habitat. Hurricanes have had major impacts on population size in the past; in 1992 Hurricane Iniki devastated forests throughout Kaua`i, and all bird populations on the island appeared to have been drastically reduced, although some have since recovered. Hurricanes are now thought to displace birds from the small area of suitable habitat at altitude and push them into the lowlands where avian malaria is prevalent. A growing concern is that rising temperatures could allow mosquitoes to survive at higher altitudes and further transmit avian malaria and avian pox, and having a montane distribution that is close to the maximum altitude within its range, this species is potentially susceptible to climate change.

Diet: Insects, larvae, and spiders. Forages among the twigs and branches of ohi'a and koa trees. Possesses a tongue that is specially designed for extracting insects from crevices in bark, unlike the tubular nectar-drinking tongue of other members of the Hawaiian honeycreeper family.

Breeding: Akikiki juveniles have “spectacles” and will retain the dull pink bill into maturity.

The Akikiki builds a simple open-cup nest between March and May, perhaps only in ohi'a trees. Both parents have been observed bringing food to the nest, with the male providing some food for the female, though the female also forages independently. A nesting pair in 2007 had a juvenile from a previous nest, indicating the species will attempt to raise two broods.

Cool Facts: While this species' core population resides in the protected Alaka'i Swamp region, it has been suggested that this site may not be ideal habitat but is utilized because optimum lowland habitat has been either lost or altered. To this end one of the key conservation strategies may be reestablishment of low elevation native forests. Meanwhile, the most important effort would be to fence portions of the Alaka'i Swamp and begin removal of feral ungulates and other introduced mammals. Lack of information on this species' life history and population dynamics is a serious impediment to recovery efforts, and studies are greatly needed. Like many other Hawaiian bird species that are in need of critical conservation, funds are lacking as is the will on behalf of the US Congress to carry out the recommended actions that may save the species from extinction.

The Zoological Society of San Diego is developing techniques for rearing *Oreomystis* creepers from eggs and breeding them in captivity, using the related Hawai`i Creeper, at the Keauhou Bird Conservation Center. The Hawai`i Creeper has been successfully propagated in captivity, and release of the captive population is planned. Captive breeding of ‘akikiki was due to begin in 2008.

The Hawaiian word, ‘akikiki probably refers to the birds’ call.

Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

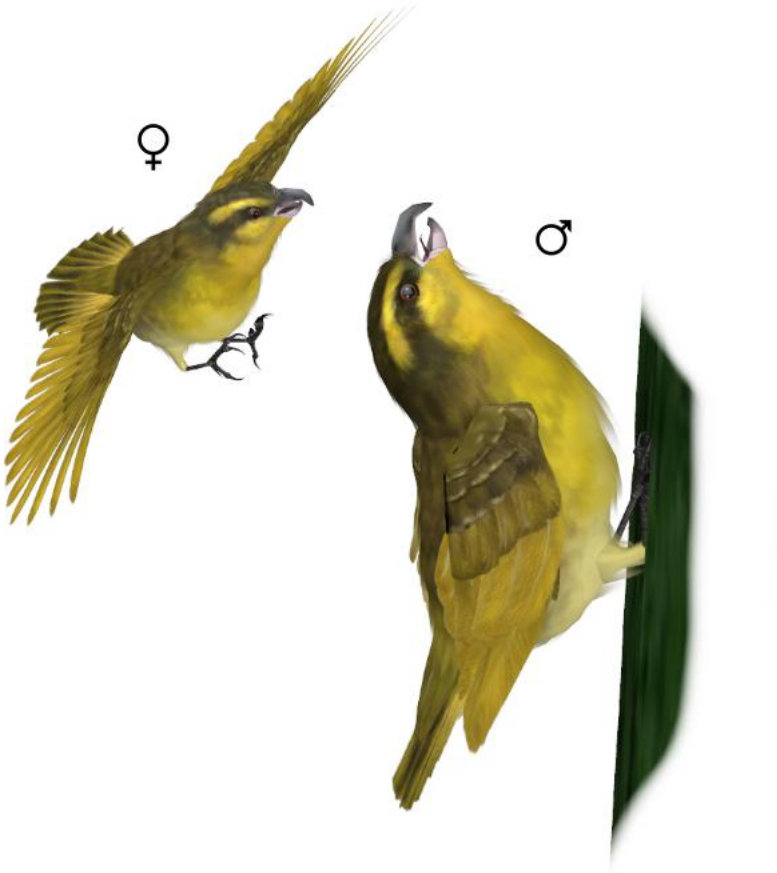
Hawaiian Name: kiwikiu
Common Name: Mau'i Parrotbill
Scientific Name: *Pseudonestor xanthophrys*

Size: 6 inches (14cm)

Habitat: : Oceania; endemic to Mau'i in the Hawaiian Islands (USA), where it is found on the north-eastern slopes of Haleakala, although fossil evidence indicates that it occurred in the lowlands and on Moloka`i.

It is now restricted to montane mesic and wet forest at 1,200-2,150 m (mainly 1,500-2,000 m), and is absent from adjacent areas dominated by exotic trees.

Status: Critically Endangered. Global Population: 500 mature individuals. From 1945 to 1995, the invasion of feral pigs on Haleakala caused chronic habitat degradation and facilitated the spread of disease-carrying mosquitoes into remote rainforests. Most of the species' range is now fenced however, and the species may respond positively as a result. However, the interaction between malaria and climate change is a potential future threat; modeling has suggested a possible population decline of c.75% by 2090. Furthermore, having a montane distribution that is close to the maximum altitude within its range, this species is potentially susceptible to climate change. Weather influences the survival of young and thus potential recruitment rates. Other limiting factors include predation and competition from exotic bird and insect species. Rats have been observed high in native 'olapa trees and are both a potential predator of eggs and young and a potential source of competition for berries. Nest predation by the Hawaiian Short-eared Owl *(Asia flammeus sandwichensis)* has been observed, though its extent and effect is unknown. Removal of small mammal nest predators may result in owl populations switching to a greater proportion of birds in their diet.



Conservation measures underway: The East Mau'i watershed is cooperatively managed with fencing at c.1,070 m and removal of feral ungulates. In the Waikamoi Preserve, Hanawi Natural Area Reserve and Haleakala National Park, conservation practices additionally combat the establishment of alien plants and, from the late 1980s, feral pigs have been controlled. As a

result, the forest understory has recovered well and non-native plant invasions have slowed. Rats are being poisoned, although only in a tiny area. A small population of the kiwikiu exists in captivity, having bred for the first time in 2000, and numbered ten individuals (three males and seven females) in 2003. Progeny from this flock will be used for a pilot release program in the mesic forests of leeward East Mau'i where weather conditions may result in higher productivity. The Leeward Haleakala Watershed Restoration Partnership has been established to restore the south side of Mau'i's forests, and the State of Hawaii is working on fencing the leeward side which still contains some old growth koa - it is possible this may become a further suitable site for the establishment of a population

Diet: Larvae and pupae of wood- and fruit-boring beetles, moths and other invertebrates. It uses its large beak and powerful jaw muscles to remove bark and wood from small trees and shrubs such as ʻākala (*Rubus hawaiensis*), kanawao (*Broussaisia arguta*), and ʻōhiʻa lehua (*Metrosideros polymorpha*), eating the insects underneath. The Mau'i parrotbill also bites open fruits in search of insects. Pairs of birds forage in a territory of 2.3 hectares (5.7 acres), which they must defend from competing parrotbills.

Breeding: Chunky, short-tailed, big-headed passerine with huge parrot-like bill. Male olive-green above, yellow below with dark streak through eye and bold, sharply defined yellow superciliary. Two-toned bill, upper third of maxilla dark, remainder pale yellowish-pink. Female is duller on the crown with a smaller bill.

The nest is cup-shaped and placed in the outer canopy forks of mature ohia (*Metrosideros polymorpha*) - a situation that may afford some protection from introduced predators. During the breeding season (November to June), one chick is usually raised per year and young are dependent on parents for 5-8 months.

Cool Facts: Its call is a short “chip”, which is similar to the Mau'i Nui ʻAlauahio, chirped every three to five seconds. It song consists of “cheer” notes that are slower and richer than the ʻākepa. It also has a short song that sounds like “cheer-wee”.

As far as anyone can determine, *Pseudonestor xanthophrys* had not historically had a common name in the Hawaiian language. The name Hawaiian kiwikiu was developed by the Hawaiian Lexicon Committee, who was contacted by the Mau'i Forest Bird Recovery Project to select an appropriate name. A naming ceremony was held in the bird's habitat in September 2010. The "kiwi" part of the name means bent or curved (e.g., sickle-shaped), which refers to the shape of the bill of this bird. "Kiu" has a double meaning, referring both to the bird's secretive ways and to a cold, chilly wind, such as the breezes in the bird's habitat.

Hawaiian Name: apapane
Common Name: ‘Apapane
Scientific Name: *Himatione sanguinea*

Size: 5 inches (13 cm)

Habitat: Oceania; the Hawaiian Islands. The Apapane can be found on six out of the eight Hawaiian Islands. Commonly found in the wet, mesic forests of 'ōhi'a lehua blossoms, located on the island of Kauai at Kokee Park, Koolau range on Oahu, and a large population of Apapane at the Volcano National Park on the island of Hawaii.

They are mostly found in high altitudes above 1250 m for protection from predators like the mongoose, rat, and deadly a*vian malaria* carrying mosquitoes These predators are the cause for the great decline in the Apapane population.

Status: Least Concern. **Global population:** 53,700 mature adult with a stable population trend. Habitat loss, avian disease, and the introduction of alien species have had the greatest impacts on 'Apapane populations. Forests have been cleared for agriculture, cattle-ranching, and development, fragmenting their habitat. Avian diseases, from the introduction by humans of mosquitoes and caged birds, effectively limit breeding populations to elevations above the mosquito line (mosquitoes can’t survive above 1,500 m for now, but global warming is changing that). The Laysan subspecies went extinct in 1923.

Diet: Primarily 'ōhi'a lehua nectar with some fruit, insects and spiders.

It forages mostly in mid and upper strata of the forest canopy. The nominate subspecies is never seen on the ground (the extinct Laysan subspecies did forage on the ground exclusively). Most are seen feeding conspicuously on outer flower clusters of 'ōhi'a lehua trees. They clean insects from small twigs and both the upper and lower surfaces of leaves, mostly in the outer crowns of the canopy. Foraging on larger branches and trunks is rarely seen.

Breeding: Sexes look alike though females are slightly smaller. Adults are bright crimson with black wings and black tails. They have a slightly decurved gray- black bill. It has prominent white patch at the under tail-coverts and lower abdomen. Juveniles have a gray-brown and buff body feathers with white under tail-coverts. Their secondaries and some of their greater coverts are rufous-to-buff on the outer webs.

Nests are mostly found in the crown of the 'ōhi'a lehua trees. The breeding season is during the months of January through July. Both parents build the nest with the construction taking 5 to 8 days. The female have approximately 2-4 white eggs with red markings. Incubation lasts 13-14 days and during this time the female does not sing at all and only she incubates the eggs. After hatching, both parents feed the young juveniles and care for them until they are ready to fledge.

Cool Facts: While ‘Apapane nests are mostly found in 'ōhi'a lehua trees there is evidence that nests have also been found in lava tubes on the Island of Hawaii.

‘Apapane are frequently found in small groups, foraging through 'ōhi'a lehua trees, hopping from flower to flower consuming the nectar; they rarely feed from the ground. The ‘Apapane have two distinct flight patterns: straight flight and a circling flight.

The 'Apapane and the 'I'iwi (*Vestiaria coccinea*) are the only two species of Hawaiian honeycreeper in which the same subspecies occurs on more than one island.

There were two subspecies recognized; *H. s. sanguinea* on main Hawaiian islands, and *H. s. freethii* on Laysan Island. The extinct Laysan subspecies differed in the plumage (scarlet vermilion,not blood red) coloration and had a shorter, stouter bill than that of the nominate race.

Hakalua Forest National Wildlife Refuge Photo: Ken Gilliland)

Hawaiian Name: ‘i’iwi
Common Name: ’I’iwi
Scientific Name: Drepanis coccinea

Size: 6.5 inches (15 cm)

Habitat: Polynesia; found on above 1,500 m elevation on the islands of Hawai‘i, Mau'i, and Kaua‘I. They are also found islands of O‘ahu and Moloka‘I but in numbers less than 50. They are now extinct on Läna‘i Island.

It breeds and winters primarily in mesic and wet forests dominated by ‘öhi‘a and koa. Their range is restricted mostly to elevations >1,250 m because of loss and destruction of forests and presence of cold-intolerant Culex mosquitoes that transmit avian diseases at lower elevations. The windward slopes of Hawai‘i, Mau'i, Moloka‘i, O‘ahu, and Kaua‘i Islands. receive 700–1,000 mm rainfall annually. The best habitat contains varying amounts of kölea (*Myrsine lessertiana*), naio (*Myoporum sandwicense*), and tree ferns (*Cibotium spp.*) in under-story. Mämane is dominant in higher-elevation, dry forests used for foraging, but breeding there is uncommon.

Common birds in same forest habitat include ‘Apapane and introduced Japanese White-eye on all islands. Hawai‘i ‘Amakihi (*Chlorodrepanis virens*), Hawaii ‘Elepaio (*Chasiempis sandwichensis*), ‘Öma‘o (*Myadestes obscurus*), and introduced Red-billed Leiothrix (*Leiothrix lutea*) on Hawai‘I. On Mau'i, it is seen with the Hawai‘i ‘Amakihi, Mau'i ‘Alauahio (Maui Creeper)

(Paroreomyza montana), and Red-billed Leiothrix and Kaua‘i ‘Amakihi (*Chlorodrepanis stejnegeri*), ‘Akikiki (Kaua'i Creeper) (*Oreomystis bairdi*), and ‘Anianiau (*Magumma parva*) on Kaua‘i.

Status: Vulnerable. Global Population: 250,000-500,000. 'I'iwis face many of the same threats facing other native Hawaiian forest birds: habitat loss, avian disease, and introduction of alien plant and animal species. Of these threats, avian diseases, combined with the possible introduction of temperate mosquitoes, may pose the greatest risk to 'I'iwi populations. 'I'iwis are extremely susceptible to avian malaria and avian pox, which are both transmitted by mosquitoes. When bitten just once by a malaria-carrying mosquito, nine of ten 'I'iwis tested died within 37 days; when bitten multiple times by infected mosquitoes, all ten ‘I’iwis died of malaria. The incidence of malaria in wild 'I'iwis is greatest during the times of year when birds move to lower-elevation forests where nectar is available, but mosquitoes are also present. Mosquito-transmitted avian diseases seem to have a greater impact on 'I'iwis than on other Hawaiian honeycreepers. Currently, mosquitoes are confined primarily to the lowlands of the Hawaiian Islands, allowing 'I'iwis relief from avian diseases at higher elevations, but if a temperate, cold-

tolerant mosquito species is introduced, it could prove disastrous for ‘I’iwis and other native Hawaiian forest birds.

Diet: Flower Nectar and some insects. 'I'iwis spend most of their time foraging on 'ohi'a trees, feeding primarily on 'ohi'a nectar, but also catching butterflies, moths, and other insects. Mämane nectar is another major part of 'I'iwis' diets, and in some areas, the nectar of the introduced banana poka is also an important food source.

Breeding: Sexes look alike. Males larger than females in all measurements. Adult is brilliant vermilion; wings and tail black. Wings have contrasting white patch on inner secondaries. It has a long (25-28 mm), deeply decurved, peach or salmon-colored bill. There is a yellow eye-ring visible at close range. The legs are salmon pink to orange. The tarsi and toes are brown. Juveniles are dull yellow with black spots. Their bills are dusky brown, becoming brighter with age.

Two eggs are laid in a cup nest of twigs, mosses, and lichens high in the crown of an 'ohia-lehua tree.

Cool Facts: The long curved bill of the 'I'iwi has evolutionally adapted to sip nectar from the long tubular flowers of the native Hawaiian lobelioids. They will pierce a hole in the base of the flower and extract the nectar with their brushy tipped tongues. They are important pollinators for many species of native plants. They forage high up in the mid to upper canopy of forests and will often defend a territory with a heavily flowering tree in it.

As the lobelioids have declined through habitat loss and extinction, 'I'iwis have shifted to feeding more on other native flowers such as the 'ohia-lehua, koa, naio, and mamane. This dietary shift has been reflected in the slight reduction in average bill length seen over the past century.

'I'iwis can produce a wide variety of calls from rusty door hinge sound to clear flute-like sounds. Their wings in flight produce distinctive whirring noise.

The Hawaiian word I’iwi probably refers to the birds’ call but also means “eye twitching”.

Hawaiian Name: 'akohekohe

Common Name: 'Akohekohe (Crested Honeycreeper)
Scientific Name: *Palmeria dolei*

Size: 7 inches (18 cm)

Habitat: Oceania; the Hawaiian Islands. Northeastern slope of Haleakala Volcano on the island of Mau'i. The species formerly occurred on the neighboring island of Moloka'i, but that population is now extinct. Almost the entire population is found between 1,500 and 2,300 meters of elevation, in forest permanently enshrouded in clouds and mist. Average rainfall is 235 to 275 inches per year. It was formerly found on the island of Moloka'i, but this population is now extinct.

Status: Critically Endangered. Global Population: 3,800 Mature individuals with a declining population trend. At this point in time, the major threats appear to be the negative effects of introduced animals (especially feral pigs) and plants. Feral pigs wreak havoc on the soil and vegetation in native forests, destroying native understory and sub-canopy plants and creating wallows that can act as breeding sites for disease-carrying mosquitoes. Rainforest areas that have been affected by pigs can recover if the pigs are removed, but these areas have higher concentrations of non-native plants. Although 'Akohekohes feed primarily in the canopy on 'ōhi'a lehua trees, they also feed on flowering understory shrubs. The destructive activities of pigs, together with the encroachment of non-native plants into formerly pristine forest, may cause 'Akohekohes to search for food at lower elevations, where infectious mosquitoes and avian diseases are common.

Diet: Primarily nectarivorous. Nectar from the 'ōhi'a lehua makes up 40-75% of these birds' diets. They also feed on the nectar of other plants, caterpillars, flies, spiders, and other invertebrates.

It actively forages alone, stopping at each flower for only a few seconds. It typically hops or runs over the continuous forest canopy, foraging from tree to tree without taking flight. Occasionally punctures a hole in base of tubular flowers of lobelias and mints to extract nectar

Breeding: Sexes look alike, although the female is slightly smaller. The females also develop a brood patch (featherless area on the belly) while the males vent area swells during mating season. Overall, the adult plumage is blackish with orange-scarlet and silver lanceolate feathers high-lighting the head, breast, back, and upper tail-coverts. There are silver tips on feathers of the cheek, crown, and forehead. There is a broad, orange eye-ring extending across the back of the eye towards the nap. The entire nape is a brilliant orange-scarlet. The flight-feathers and tail are black, often with white tips. The primary margins are white. The wing shoulders are white and orange and the thighs are orangish. The black bill is slightly decurved and slender. The egs and feet black with the toe pads being whitish gray.

Most prominent feature on adults is a bushy whitish gray feather crest that extends approximately 1 cm from forehead, curves over top of bill, and partially conceals nostril. The musty sweet drepanid odor, unique to many honeycreepers, is obvious when ‘Äkohekohe are held in hand or on close inspection of nest.

Breeding appears to begin in February-March. No nests have been described, although immature birds have been observed with adults in May-August.

Cool Facts: The Hawaiian name for this species, pronounced "ah ko-hay ko-hay," comes from a commonly heard call that it makes.

The ‘Akohekohe is very aggressive and will chase off ‘Apapane and I’Iwi for possession of 'ōhi'a lehua blossoms.

Captive raising of 'Äkohekohe is currently being initiated by joint efforts of The Peregrine Fund, state of Hawai'i Department of Land and Natural Resources, U.S. Fish and Wildlife Service, and PIERC/BRD. Future plans include release of birds where 'Äkohekohe exist in lower numbers; reproduction in captivity is being attempted but has not occurred in first year of project. Abundance of mosquitoes below 1,500 m elevation would hinder reintroduction of 'Äkohekohe into native habitats on Mau'i and Moloka'i where they once existed.

The Hawaiian name of the bird refers to the short crest feathers which were deemed reminiscent of pubic hair.

Hawaiian Name: po'o-uli

Common Name: Po'o-uli (Black-faced Honeycreeper)

Scientific Name: *Melamprosops phaeosoma*

Size: 5.5inches (14 cm)

Habitat: Oceania; Hawaiian Islands North-eastern slopes of Haleakala on the island of Mau'i.

It was found in the 'Ohi'a-lehua forests.

Status: Extinct (2019). **Global Population:** 0. In 1973, the estimated population was felt to be less than 200 birds. The dramatic population decline has been attributed to a number of factors, including habitat loss, mosquito-borne diseases, predation by pigs, rats, domestic cats, and mongooses and a decline in the native tree snails that the Po'o-uli relies on for food. By the original printing of this manual in 2007, it was believed that there were only two males left with the last remaining female dying in late 2004.

A 2018 study recommended declaring the species extinct, citing bird population decline patterns and the lack of any confirmed sightings since 2004, and in 2019, the species was declared extinct.

Diet: Snails, insects, spiders; rarely fruit.

Nesting: A medium-sized, robust Hawaiian honeycreeper; the only one with black mask and brown body. The wings were short and rounded. The tail so short that bird appears almost tail-less with it being notched and curved downward. The feathers were unusually pliable. The legs were sturdy and feet large. The bill conical, finchlike, slightly hooked and black. The dimorphic differences in size are unknown. All ages and both sexes easily distinguished from other honeycreepers by combination of extensive black mask, whitish cheek-patch and throat, brown dorsal plumage, and very short tail. Adult males were creamy white below while females were gray below. Juveniles had smaller masks than those of adults and were whitish below. Immature males were more similar to adult females.

The nests were built of twigs and mosses and were located in leafy branches of Ohi'a-lehua trees. Generally, 1-2 eggs were laid.

Cool Facts: Po'o-uli, in Hawaiian loosely translates, "Dark Head" or "Bandit Mask".

There was a desperate attempt to save a species.

"In 2002, a female was captured and taken to a male's home range in an attempt to get them to breed. The female, however, had flown back to her own nest, which was a mile and a half away, by the next day. There was also a ten-day expedition which was scheduled to begin on April 27, 2004. The goal of this was to capture all three birds, and bring them to a bird conservation center on the island in the hope they would produce offspring.

On September 9, 2004, a male Po'o-uli was captured and taken to the Mau'i Bird Conservation Center in Olinda, in an attempt to captively breed the bird. However, biologists could not find a mate for the male before it died of avian malaria on November 28, 2004. Biologists are now searching for the two remaining birds, which have not been seen for over a year and are probably dead too. Tissue samples have been taken from the male for possible future cloning, but as neither birds of the opposite sex are now available nor natural behavior can be imprinted on possible cloned individuals (assuming that cloning of birds will actually be established as a working technique, which currently is not the case), this does not seem probable. As such efforts would likely compete with conservation funding of extant bird species, it may not even be desirable as a cloning attempt would both be highly likely to fail and at the same time jeopardize the survival of other highly threatened species". (VanderWerf et al. (2006)).

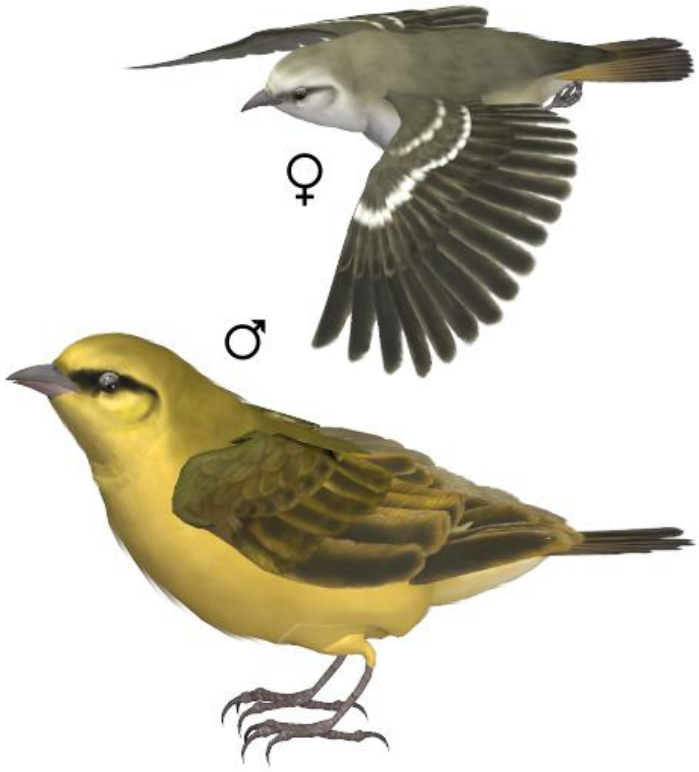
Hawaiian Name: O‘ahu ‘alauahio
Common Name: O’ahu Creeper
Scientific Name: Paroreomyza maculata

Size: 4 inches (11 cm)

Habitat: Oceania; Endemic to O`ahu in the Hawaiian Islands (USA), where fossil evidence indicates that it once occurred in the lowlands. In the past few decades, there have only been a few confirmed sightings, with several of these from the area around North Halawa Valley, Ko`olau range. The last well-documented observation was of two birds on December 12, 1985 on Poamoho Trail during the Waipi`o Christmas Bird Count.

Recent sightings have been between 300 and 650 m in remnant native, lowland mesic to wet forest.

Status: Extinct (1992). Global Population: 0. The species was common there in the late 19th century, but rare by 1930. The last probable sighting was in 1990. The final sightings of this species were in the mid to upper regions of the Ko’olau Mountains between 980 and 2,132 feet, where there is remnant native lowland forest that has been degraded by introduced plants. Extensive surveys by state biologists in 1992 failed to detect the species, which is now considered extinct.



Deforestation and mosquito-borne avian diseases are likely among the chief reasons for this bird's disappearance. Predation may also have played a role, though there is no evidence to support this theory, since the bird had become so rare even 70 years ago. Presumably Short-eared Owls and introduced cats, rats and mongoose preyed on the birds, and pigs and other domestic ungulates degraded its habitat.

Diet: Invertebrates. It foraged on trunks and limbs of trees and shrubs, probing the bark for insects. In the 1890s, it was reported to eat quantities of carabid beetles, most likely wood-borers, as it was seen feeding on the dead branches of koa trees.

Nesting: Small, straight-billed, warbler-like passerine. Male yellow below, olive-green above, with dark lores fading into olive eye-stripe, and distinct yellow forehead and superciliary. Female greenish-gray above, pale yellowish-white below, with two prominent, pale wing-bars, pale lores and forehead, and dark eye-stripe.

Little is known of nesting habits. One nest with two eggs was collected in late January 1901.

Cool Facts: Surveys have been carried out during the 1990s to search for this species, but have failed to find any birds. A "Rare Bird Discovery Protocol" has been developed which could be applied to this species in the event of its rediscovery.

Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

Hawaiian Name: kakawahie
Common Name: Moloka'i Creeper
Scientific Name: Paroreomyza flammea

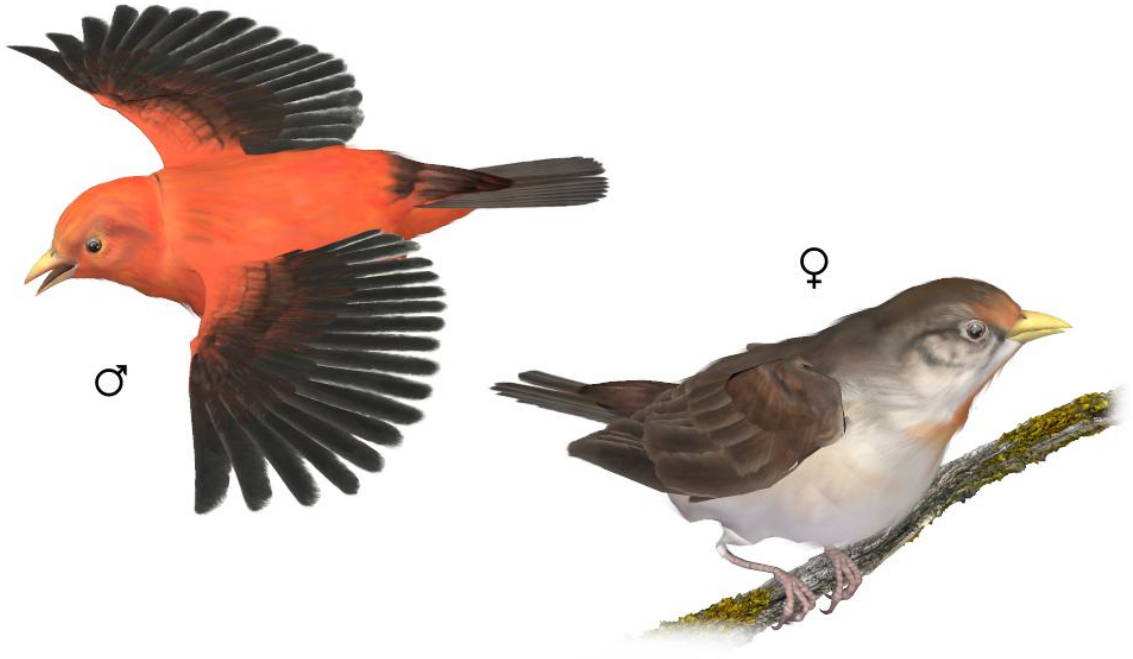
Size: 5 inches (13 cm)

Habitat: Oceania; Hawaiian Islands. Endemic to Moloka`i. Found in wet `ohi`a forests above 500 m.

Status: **Extinct (1962).** **Global Population:** 0. It was common in the 1890s, but became extinct over the first half of the 20th century. The last record was in the Kamakou Preserve in 1962. Its extinction was presumably due to habitat destruction and disease.

Diet: Insects, and spiders. Often foraged on tree trunks, branches and leaves.

Nesting: Males were bright scarlet; females rusty brown above, buffy white bellies with variable amount of orange on throat and breast.



Cool Facts: British ornithologist Scott Barchard Wilson discovered the Moloka'i creeper in the late 19th century while lost on a trail in the Moloka'i forest. He was hiking with a Hawaiian guide in the highlands of Kalae near what is now the R.W. Meyer Sugar Mill and Museum, when a penetrating mist brought the visibility in the forest down to zero. He later wrote:
"While we were wandering about and searching for the trail, I heard a curious sound-a continued chip, chip, chip, not unlike the sound of chopping wood. At first I did not think it could belong to a bird; soon, however, I was undeceived, as a flash of brilliant orange color passed us in the fog."

His journal describes a method of study foreign to 20th century ornithologists. "The continuous metallic note enabled me to get within range and I fired, bringing down two birds, which proved

to be male and female. Soon afterwards I shot another of the bright-colored males. We had by this time hopelessly lost our way, and the consequences might have been serious; so we were extremely glad to hear revolver shots at no great distance, which proved to be fired by Mr. Meyer's sons, who had come in search of us."

Wilson collected the Moloka'i creeper and other birds and sailed back to England with their pelts and his journals. F.W. Frohawk made artistic renderings to depict the birds in nature.
Little did Wilson know that the Moloka'i creeper was on the verge of extinction. Hunting the bird for its colorful feathers to stitch into Hawaiian capes and for use in musical instruments and ceremonial implements had reduced the population before western explorers reached Moloka'i's mountains. Grazing, farming and logging by newcomers cleared many forests. The introduction of other birds into the Hawaiian islands also reduced the habitat for the kakawahie before Wilson arrived.

The last living specimen was seen in 1962 at Ohialele Plateau, one of the most isolated ecological niches in Hawai'i, located above Pelekuna Valley. This plateau is part of Kamakoa Preserve, which is managed by the Nature Conservancy and spreads across 2,744 acres of Moloka'i. It is home to more than 250 kinds of Hawaiian plants and remains a sanctuary for other endangered forest birds amakahi and apapane.

The Hawaiian name for this species, Kaka-wahie, means "to break up firewood," which describes the chipping call of this beautiful bird.

Koa Trees at Hakalua Forest National Wildlife Refuge (Photo: Ken Gilliland)

Hawaiian Name: Hawai'i mamo
Common Name: Hawai‘i Mamo
Scientific Name: *Drepanis pacifica*

Size: 8 inches (20 cm)

Habitat: Oceania; endemic to the big island of Hawai`i (USA). It inhabited forest canopies; especially Ohi'a-lehua forests.

Status: **Extinct (1899).** **Global Population:** 0. It was heavily trapped by Hawaiians for their feathers, but it is more likely that habitat destruction and disease were the ultimate causes of the species' extinction. European settlers changed the Mamo's habitat to support agriculture and cattle ranching, which damaged the bird's food source. The cattle roamed loose in the forests, destroying the understory ecosystem. Even though this was discovered early and was well known to the Hawaiians, the Mamo quickly disappeared.

Avian pox may have killed any birds that survived habitat destruction. There are many specimens of this bird in American and European museums. The bird seemed to disappear in 1899, but reports of this bird continued for a few more years. The last confirmed sighting was in July 1898 near Kaumana on the island of Hawai‘i by a collector, Henry W. Henshaw, who, as mentioned by Tim Flannery in his book, A Gap In Nature, shot and wounded a bird he was stalking, before it escaped with another bird.

Diet: Flower nectar.

Breeding: The male and female of the species looked similar.

Cool Facts: The Mamo was one of the most honored birds in Hawaiian society. Its orange feathers were used to create capes and hats (featherwork) that were used by royalty. Feather collecting contributed to the bird's decline. The famous yellow cloak of Kamehameha I is estimated to have taken the reigns of eight monarchs and the golden feathers of 80,000 birds to complete.

Hawaiians collected the birds by removing sap from sandalwood trees and breadfruit to create a sticky paste that they placed near the blossoms of lobelias. A hungry Mamo would drink the nectar, and its feet would get stuck in the sap.

Some scientists claim that after plucking, Mamo were kept as pets, or cooked. Others claimed that the birds were released, and that there was a Kapu or restriction that required live release. Even if the birds were released, they would still be in a state of shock and risk injury. However, Hawaiian birds are relatively tame and unafraid when captured, and so might have survived handling better than most birds.

The Hawaiian name probably is a corruption of Hoohoo ('O'o) and relates to the birds' calls.

Kalâkaua a he inoa	Kalâkaua is his name
Ka pua mae`ole i ka la	A flower that wilts not in the sun
Ea ea ea ea	Tra la la la
Ke pua maila ika mauna	Blooming on the summit
Ke kuahiwi o Maunakea	Of the mountain, Mauna Kea
Ea ea ea ea	Tra la la la
Ke `a maila i Kilauea	Burning there at Kilauea
Malamalama o wahine kapu	The light of the sacred woman
Ea ea ea ea	Tra la la la
A luna o Uwe Kahuna	Above Uwe Kahuna
Ka pali kapu o Ka`au	The sacred cliff of Ka`au
Ea ea ea ea	Tra la la la
Ea mai ke ali`i kia manu	The bird catching chief rises
Ua wehi i ka hulu o ka mamo	Adorned with feathers of the mamo bird
Ea ea ea ea	Tra la la la
Kalâkaua a he inoa	Kalâkaua is his name
Ka pua mae`ole i ka la	A flower that wilts not in the sun
Ea ea ea ea	Tra la la la

Hawaiian Name: o'o nuku'umu
Common Name: O'o nuku'umu (Black Mamo)
Scientific Name: *Drepanis funerea*

Size: 8 inches (20 cm)

Habitat: Oceania; Hawaiian Islands (Moloka'i, Hawai'i and fossils found Mau'i). Found in forest under-story.

Status: Extinct (1907). Global Population: 0. The Black Mamo was one of the last Hawaiian honeycreepers discovered and one of the least colorful. The little we know of the Black Mamo comes mainly from R. C. L. Perkins, who discovered the species on Molokaʻi in 1893, and

William Alanson Bryan, who collected the last specimens in 1907. Collectors zeal to find the last of Hawaiʻi's disappearing endemic birds at the time was lampooned at the time as an activity that "amounted to wanton slaughter" of the birds. Despite their activities, science is indebted to them for saving what they could before it was too late.

Barbara and Richard Mearns accurately state, "The extirpation of many of the forest birds of the Hawaiian Islands has been caused by the destruction of habitat, the introduction of ground predators and by mosquito-borne diseases, three factors that continue to be a problem and are

likely to lead to further extinctions. The collecting activities of the early naturalists had little effect on the bird populations and but for their efforts some species would not be known to us at all."

Diet: Flower nectar (primarily arboreal lobelia and Ohi'a-lehua) and some insects.

They spend only a few seconds over each flower, darting their tongues very rapidly in and out.

Nesting: Both sexes were alike although the beak of the male is perhaps longer and the female may be generally smaller.

Cool Facts: R.C.L. Perkins first discovered this beautiful jet-black bird in 1893 in Pelekunu Valley on Moloka'i. The last sightings of the bird were in 1907, but they were seen further to the east on the island. A survey on Moloka'i in 1936 for it failed to find any specimens. Perkins believed that in most respects, including the voice, this species closely resembled the Hawaii mamo, *Drepanis pacifica*. Black mamos were so tame that their discoverer was able to watch them at very close quarters as they worked their way from one large flower to another.

The last Black Mamos were observed in 1907 by a collector, Alanson Bryan, who had shot three birds. Tim Flannery quoted him as having written, "To my joy I found the mangled remains hanging in the tree in a thick bunch of leaves, six feet or more beyond where it had been sitting."

The Hawaiian name refers to " 'O'o with the sucking beak"

'ohia-lehua (Photo: Ken Gilliland)

The following is a complete list of bird species endemic only to the Hawaiian Islands:

Procellariidae
- Hawaiian Petrel ʻUaʻu, Pterodroma sandwichensis (VU)
- Newell's Shearwater or ʻAʻo, *Puffinus newelli* (EN)

Anatidae
- Hawaiian Goose or Nēnē, *Branta sandvicensis* (VU)
- Hawaiian Duck or Koloa maoli, *Anas wyvilliana* (EN)
- Laysan Duck, Anas laysanensis (CR)

Accipitridae
- Hawaiian Hawk or ʻIo, Buteo solitarius (NT)

Rallidae
- Laysan Rail, Porzana palmeri †
- Hawaiian Rail, Porzana sandwichensis †
- Hawaiian Moorhen or ʻAlae ʻula, Gallinula chloropus sandwichensis
- Hawaiian Coot ʻAlae keʻokeʻo, Fulica alai (VU)

Recurvirostridae
- Hawaiian Stilt or Aeʻo, Himantopus mexicanus knudseni

Laridae
- Hawaiian (Black) Noddy or Noio, Anous minutus melanogenys

Strigidae
- Pueo, Asio flammeus sandwichensis

Meliphagidae
- Kauaʻi ʻŌʻō, Moho braccatus †
- Oʻahu ʻŌʻō, Moho apicalis †
- Molokaʻi ʻŌʻō, Moho bishopi †
- Hawaiʻi ʻŌʻō, Moho nobilis †
- Kioea, Chaetoptila angustipluma †

Corvidae
- Hawaiian Crow or ʻAlala, Corvus hawaiiensis (EW)

Monarchidae
- Kauaʻi ʻElepaio, Chasiempis sandwichensis sclateri (VU)
- Oʻahu ʻElepaio, Chasiempis sandwichensis ibidis (VU)
- Hawaiʻi ʻElepaio, Chasiempis sandwichensis sandwichensis (3 races) (VU)

Sylviidae
- Laysan Millerbird, *Acrocephalus familaris familaris* †
- Nihoa Millerbird, *Acrocephalus familaris kingi* (CR)

Turdidae
- Kamaʻo, *Myadestes myadestinus* †
- ʻĀmaui, Myadestes oahensis †
- Olomaʻo, *Myadestes lanaiensis lanaiensis* (CR-EX)
- ʻOmaʻo, *Myadestes obscurus* (VU)
- Puaiohi, Myadestes palmeri (CR)

Drepanididae
- Laysan Finch, Telespiza cantans (VU)
- Nihoa Finch, Telespiza ultima (CR)
- ʻŌʻū, Psittirostra psittacea (CR)
- Lanaʻi Hookbill, Dysmorodrepanis munroi †
- Palila, Loxioides bailleui (EN)
- Lesser Koa-finch, Rhodacanthis flaviceps †
- Greater Koa-finch, Rhodacanthis palmeri †
- Kona Grosbeak, Chloridops kona †
- Maui Parrotbill, Pseudonestor xanthophrys (CR)
- Kauaʻi ʻAkialoa, Hemignathus ellisianus procerus
- Oʻahu ʻAkialoa, Hemignathus ellisianus ellisianus
- Maui Nui ʻAkialoa, Hemignathus ellisianus lanaiensis
- Lesser ʻAkialoa, Hemignathus obscurus †
- Common ʻAmakihi, Hemignathus virens (LC)
- Oʻahu ʻAmakihi, Hemignathus flavus (VU)
- Kauʻi ʻAmakihi, Hemignathus kauaiensis (VU)
- Greater ʻAmakihi, Hemignathus sagittirostris †
- Oʼahu Nukupuʻu, Hemignathus lucidus †
- Kaua'i Nukupuʻu, Hemignathus hanapepe †
- Maui Nukupuʻu, Hemignathus affinis †
- ʻAkiapolaʻau, Hemignathus munroi (EN)
- ʻAnianiau, Magumma parva (VU)
- ʻAkikiki, Oreomystis bairdi (CR)
- Hawaiʻi Creeper, Oreomystis mana (EN)
- Oʻahu ʻAlauahio, Paroreomyza maculata (CR)
- Maui ʻAlauahio, Paroreomyza montana (EN)
- Kakawahie, Paroreomyza flammea †
- ʻAkekeʻe, Loxops caeruleirostris (CR)
- ʻAkepa, Loxops coccineus (EN)
- ʻUla-ʻai-Hawane, Ciridops anna †
- ʻIʻiwi, Vestiaria coccinea (TH)
- Hawaiʻi Mamo, Drepanis pacifica †
- Black Mamo, Drepanis funerea †
- ʻAkohekohe, Palmeria dolei (CR)
- ʻApapane, Himatione sanguinea (LC)
- Poʻouli, Melamprosops phaeosoma †

Special Thanks to…

….my beta team (FlintHawk, Linda, Jan, Rhonda and Sandra)

Species Accuracy and Reference Materials

Many birds of the same species do vary considerably in color. This package tries to emulate the colors and markings in the most commonly found variants.

The author-artist has tried to make these species as accurate to their real life counterparts as possible. With the use of one generic model to create dozens of unique bird species, some give and take is bound to occur. The texture maps were created in Painter with as much accuracy as possible. Photographic references from photographs from various Internet searches and several field guides were used.

Sources for this Volume and Field Guide

Books, Magazines and Papers

- "**The Sibley Guide to Birds**" by David Allen Sibley. Allred A. Knopf, New York 2001
- **"Birds of Hawaii and the Tropical Pacific"** by H. Douglas Pratt, Phillip L. Bruner and Delwyn G. Berrett, Princeton Press, 1989.

Websites

- Wikipedia (http://www.wikipedia.com)
- Honolulu Zoo (http://www.honoluluzoo.org/)
- Birdlife International (http://wwwbirdlife.org)
- US Fish and Wildlife Pacific Islands (http://www.fws.gov/pacificislands)

Road closed due to lava, Volcano National Park (Photo: Ken Gilliland)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