

NATIVE WATERBIRDS

These newly-created wetlands have been rapidly colonized by native waterbirds, including four species that are highly endangered and found only in the Hawaiian Islands. The **'Alae 'Ula**, or Hawaiian Moorhen (*Gallinula chloropus sandvicensis*), and **Koloa Maoli**, or Koloa Duck (*Anas wyvilliana*), have by now raised many broods here, nesting among the native sedges. The **Ae'o**, or Hawaiian Stilt (*Himantopus mexicanus knudseni*), and the **Nēnē**, or Hawaiian Goose (*Branta sandvicensis*), stop by almost daily to rest and feed. In the morning and evening, watch for the **'Auku'u** or Black-crowned Night Heron (*Nycticorax nycticorax*). Long-distance migrants such as the **Kōlea** or Pacific Golden Plover (*Pluvialis fulva*) stop to rest and often winter here, as part of their annual 10,000-mile migration from breeding grounds in the Arctic to wintering sites in the tropics. **Bones of all these bird species occur as fossils in the sediment of adjacent Makauwahi Cave, showing that they have thrived here for thousands of years.**



'Alae 'Ula
(Hawaiian Moorhen)



Koloa Maoli
(Koloa Duck)



Ae'o
(Hawaiian Stilt)



Nēnē
(Hawaiian Goose)



'Auku'u
(Black-crowned Night Heron)



Kōlea
(Pacific Golden Plover)

MAHALO

The late Rev. Dana Kaohelauli'i Sr., Joe Kanahale, and the Ni'i'hau 'Ohana for creation and malama of the lo'i pondfields; Dr. Julian Hume and Wendy Hollender for illustrations of birds and plants, respectively; Hob Osterlund for bird photographs; Dr. David Burney and Lida Pigott Burney for text, photos, and concept; Design Asylum Inc. for design and production.

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LO'I KALO Wetland Restoration with Traditional Hawaiian Agriculture

The wetland restoration in front of you was an abandoned sugar cane field as recently as 2012. Since then, 15 pondfields or **lo'i** have been created here by Makauwahi Cave Reserve staff, interns, local school children, and "volun-tourists." Old maps, oral history, and archaeology all indicate that Hawaiians have enhanced and farmed wetlands here for centuries. By catching flood waters and nutrients in clay walls surrounding flat areas, traditional Polynesian agriculture conserves water and reduces erosion. These time-honored methods also provide environments for native plants and animals, some endangered and in urgent need of more habitat.

The taro (*Colocasia esculenta*), or **kalo** in Hawaiian, was the mainstay of the ancient Hawaiian diet. A crop is first planted in shallow water or mud, using the **huli**, sprouts cut off the top of mature root crowns. At maturity, the plants are pulled out of the mud. The swollen roots are cooked and pounded into **poi**. The tops of the plants are then replanted, whereupon they eventually grow a new root system, and the ancient cycle is renewed.



Planting



Harvesting



Processing

AVIAN NEWCOMERS

Many non-native birds are attracted to the wetland restoration as well. The long-necked white waders are Cattle Egrets, native to the Old World. Non-native songbirds include the Common Myna, White-rumped Shama, two unrelated kinds of cardinals, and three kinds of doves. Many of these exotic species probably became established in recent decades as escaped cage birds. **Before the accidental introduction of mosquitoes in the 19th century and bird diseases they carry, these coastal lowlands were home to native honeycreepers and other native songbirds, preserved abundantly in the fossil record of Makauwahi Cave.**



Cattle Egret



White-rumped Shama



Red-crested Cardinal

EXTINCT DUCKS AND GEESE

Too late to see these! The sediments of Makauwahi Cave contain the bones of several remarkable kinds of extinct ducks and geese. Evidence indicates that all these "waterfowl" had adaptations for life primarily on land. These birds had very large feet and tiny wings, having abandoned flying here in the islands where there were no mammalian predators before the arrival of humans. Some, like the Turtle-jawed **Moa-Nalo** (*Chelychelynechen quassus*) and the **Nēnē-Nui** (*Branta aff. hylobadistes*), the large flightless cousin of the **Nēnē**, were the large grazing animals of pre-human Kaua'i. A strange little flightless duck known only from fossils in Makauwahi Cave, called the Kaua'i Mole Duck (*Talpanas lippa*), probably fed on the forest floor at night, foraging for insects in the manner of the Kiwis of New Zealand.



Turtle-jawed Moa-Nalo
(*Chelychelynechen quassus*)



Nēnē Nui
(*Branta aff. hylobadistes*)



Kaua'i Mole Duck
(*Talpanas lippa*)

MAKAUWAHI CAVE RESERVE

Makauwahi Cave Reserve is a non-profit organization with Garden Island Resource Conservation and Development, Inc. as a fiscal sponsor. The property is owned by Grove Farm Company, and managed by Lida Pigott Burney, Dr. David A. Burney, and Reserve staff, with the help and support of thousands of volunteers, students, and visitors from the local community and around the world.

For more information about tours, volunteering, internships, and donating, go to www.cavereserve.org or email makauwahi@gmail.com.

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