

Update on Recovery Efforts for the Po'ouli

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INTRODUCTION

The purpose of this article is to provide an update and inform the public about recent and ongoing efforts to recover the Po'ouli (*Melamprosops phaeosoma*), including: 1) a brief chronology of recent events; 2) a summary of the outcome of an attempt to translocate a female Po'ouli into the home range of the male; 3) the need for a new recovery strategy and an explanation of how the decision was reached to bring the remaining birds into captivity; 4) details on the methods and protocols used for attempting to capture, transport, and acclimate Po'ouli to captivity; and 5) how these actions fit into the overall recovery strategy for the Po'ouli. We hope this article will provide information to those interested in this issue, raise awareness about the plight of the Po'ouli and other endangered Hawaiian forest birds, and satisfy concerns about the welfare of the birds during these activities and their long-term survival.



Photo by Paul Baker, Maui Forest Bird Recovery Project

CHRONOLOGY OF RECENT EVENTS

The Po'ouli was first discovered in 1973 and is endemic to Maui (Casey and Jacobi 1974). Historically, it has been confined to a 1,300 hectare (3,200 acre) area of wet montane forest on the northern and eastern slopes of Haleakala (Mountainspring et al. 1990), but fossil evidence indicates Po'ouli once inhabited drier forests at lower elevation on the leeward slope of Haleakala (James and Olson 1991). The population was estimated at 140 ± 280 in the early 1980s (Scott et al. 1986), but estimates of population size and density are imprecise because of the species' low density and cryptic behavior. Numbers and range declined from 1976-1985 (Mountainspring et al. 1990), and surveys from 1994-1995 found only six Po'ouli at four locations, while surveys from 1997-2000 located only three birds (Reynolds and Snetsinger 2001). No other Po'ouli have been located since

these three birds were color-banded in 1997 and 1998 (Hawaii Department of Land and Natural Resources [DLNR], unpubl. data). Currently there are no known breeding pairs, and the last documented reproduction occurred in 1995 (Reynolds and Snetsinger 2001). Genetic sexing of the three known birds has produced conflicting results, but the best available information indicates they consist of one male and two females. These birds occur between 1,500 meters (5,000 feet) and 1,950 meters (6,500 feet) elevation in Hanawi Natural Area Reserve (Hanawi) in non-overlapping home ranges separated by 0.75 to 1.7 kilometers (Sparklin et al. 2003). They have never been observed together during the six years since they were banded, and it is very unlikely any breeding will occur without direct intervention.

Conservation efforts for the Po'ouli have included creation of the 3,035 ha (7,500 acre) Hanawi Natural Area Reserve to provide additional protection for lands encompassing the known range; fencing of 800 ha (2000 acres) in the upper portion of Hanawi by 1996 and removal of all ungulates by 1997 (Bill Evanson, Maui DOFAW, pers. comm.); protection of adjacent forest through acquisition and management of lands by the National Park Service and formation of the East Maui Watershed Partnership (DLNR 1996); and ground-based predator

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Bird of the Month

Hawaiian Coot (*Fulica alai*) or 'Alae Ke'oke'o



Photo by Tom Dove

The Hawaiian Coot is found on all the main islands in marshes, ponds, and wetlands, and is often found on brackish water. Formerly classified as a race of the American Coot (*Fulica americana*), the Hawaiian Coot is endemic, and is darker, has a more slender bill, and a larger frontal shield than the American Coot.

The 'Alae Ke'oke'o is about 14" and is grayish-black with a white bill and frontal shield. White undertail feathers can be seen when the bird is swimming. Although the Coot may look similar to the Moorhen, it has lobed toes and is more ducklike.

On the game bird list until 1939, the bird is now listed as Endangered and protected by State and Federal law. Threats to its existence are the same as with any ground-nesting wetlands bird: disappearance of marshes and wetlands, and predation by rats, dogs, and cats.

Large floating nests of aquatic plants are built by coots, in which they lay 4 to 10 eggs. Nesting season appears to be between April and September. The fuzzy black chicks are able to run and swim as soon as their down has dried after hatching.

The coot is not as shy as the Moorhen, and much more easily seen. Ka'elepulu Pond and Hamakua Marsh in Kailua, O'ahu are good places to find them, and wetlands on neighbor islands will be just as rewarding.

[information taken from Hawaiian Birdlife by A.J. Berger (1972), and Hawaii's Birds, by Hawaii Audubon Society (1996). Many thanks, again, to Tom Dove for the use of his beautiful Coot photo.]

Memorial Weekend Service Project to Manuka Natural Area Reserve

Manuka is the largest Natural Area at 25,000 acres is among the best examples of a native mesic forest community to found today in the state of Hawai'i. Meaning it's not too wet, not too dry, but just RIGHT!

The forest represents a high diversity of vegetation in various stages of succession on 2000 to 4000-year old lava flows. In addition to seeing lots of native plants, we will have great opportunities to see native forest birds including 'Apapane, 'Amakihi, 'Elepaio and 'Io and the elusive 'Ope'ape'a (Hawaiian hoary bat).

Over the Memorial Weekend (May 24-26), Sharon Reilly and Betsy Gagne, Botanist extraordinaire, will be leading a Sierra Club Service trip to the Natural Area Reserve. We will be doing alien plant control and outplanting of rare native plants. Hopefully there will also be enough time in the afternoons and early evening to hike some of the trails. No trip would be complete without a hike up Ha'ao spring, one of the few places on the Big Island to see water bubbling directly out of the ground. Our worksites will range from 1000' to 5000' which means be prepared for hot dry weather to wet and cool.

Accommodations are provided by the Hawai'i Division of Forestry and Wildlife at the Kiolaka'a cabin. Inside the cabin there are sleeping arrangements for 6 people in 3 bedrooms but there is lots floor space and room for pitching tents outside. The cost of the trip is currently priced at \$200 and includes round trip airfare, transportation and most meals (all except for the first day's lunch). If the price of the trip is less, a refund of any overpayment will be provided.

If you are interested in participating in this trip, please call Sharon Reilly 551-5926 (cell) for more details.

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control in the home ranges of the three known birds (Malcolm et al. 2002). Ecological and life-history research was carried out under the direction of the USGS Biological Resources Division during 1994-1996 (Baker 2001).

Alternative recovery strategies for the Po'ouli were outlined in 1999 as part of an Environmental Assessment (EA) titled "Proposed Management Actions to Save the Po'ouli" (USFWS and Hawai'i DLNR 1999). Based on that EA and subsequent public comments, it was determined that the preferred alternative at that time was continued habitat management in conjunction with translocation of a female into the home range of the male, in hopes that they would form a breeding pair and nest.

Based on that recommendation, translocation methods were developed by the Maui Forest Bird Recovery Project, using the non-endangered Maui Creeper (*Paroreomyza montana*) as a surrogate species. Sixteen Maui Creepers were translocated between the Po'ouli home ranges using different methods of confinement during transport and over varying distances. All experimental trials resulted in zero mortality, and white blood cell counts indicated that stress levels were lower in birds transported with a minimum of restriction on their movement within the transport container (Groombridge et al. in review a). These trials demonstrated that Hawaiian honeycreepers could be safely transported on foot over the steep and rugged terrain separating the Po'ouli home ranges, and helped to identify the best methods and protocols for translocating the Po'ouli.

Following the surrogate translocation work, a holding-cage to allow brief observation of a captive Po'ouli immediately after its translocation and prior to its release was designed by Peter Luscomb of the Honolulu Zoo. The 30x30x60 cm holding-cage was constructed from soft white cloth walls stretched within a lightweight rigid frame, and was designed to house two birds separately side-by-side. If it became necessary to hold a single Po'ouli in field captivity for several days, either as a result of injury or due to weather conditions that precluded helicopter transport, then the holding-cage could separately house a 'tutor' individual of an ecologically-compatible species (e.g., Maui Parrotbill) to encourage acclimation and feeding behavior. Sliding panels partitioning the two compartments afforded a level of control over the extent to which the birds could view each other. An externally mounted video camera provided continual remote monitoring of the bird's behavior via a television monitor 20 m away. Both natural food, such as native *Succineid* snails (Baldwin and Casey 1983), and supplemental foods routinely used for captive propagation of other insectivores, including waxworms and mealworms, were provided inside the holding cage.

Veterinary facilities were set up in Hanawi to deal with possible injuries to a Po'ouli. Requirements focused on delivering a veterinary capacity that could handle critical medical requirements for a period of up to three consecutive days, a time frame considered to be a likely delay to any helicopter evacuation of an injured Po'ouli due to bad weather. Veterinary equipment consisted of an avian intensive care unit with a controlled environmental temperature and oxygen enriching capacity, general anesthesia and surgical capabilities, equipment and supplies to treat traumatic injuries, antimicrobial drugs, and diagnostic equipment required to perform complete blood counts, cytology, and harvest plasma for chemical analy-

sis. In the event of a death of a Po'ouli, various tissues would be collected for cell culture and immediately sent to both the Zoological Society of San Diego, Center for the Reproduction of Endangered Species and the Audubon Nature Institute Center for Research of Endangered Species. Further details are available in Groombridge et al. (in review b) and on the Internet at www.mauiforestbird.org.

In December 2001, the USFWS approved a permit request and a detailed protocol submitted by the Hawai'i Division of Forestry and Wildlife to carry out a Po'ouli translocation. After nearly two years of preparation, efforts to capture and translocate Po'ouli began in January 2002.

TRANSLOCATION OUTCOME

The results of the translocation are fully described by Groombridge et al. (in review b). The information below is provided as a brief summary. On April 4, 2002, the female Po'ouli from the area known as "home range 1" (HR1) was captured and translocated 2.5 kilometers on foot into the home range of the male (HR3). Transit time for the bird was one hour and 15 minutes. Upon arrival, the female was examined by an avian veterinarian (Dr. David Phalen, Texas A&M University) and determined to be in good health. Following examination, a radio transmitter was attached to the bird, and it was observed for approximately two hours in the holding cage. While in captivity, the bird consumed several food items, including non-native waxworms and native *Succineid* snails. The female Po'ouli was released within the male's home range at dusk that evening. The following morning, radio telemetry signals confirmed that she had roosted within the male's home range overnight and was still present. However, signals throughout the morning indicated that she was steadily moving back toward her own home range, and by that evening she had traveled back to her capture site. The female Po'ouli was radio-tracked for nine days within her home range following her return. It is not known whether the two birds encountered one another, but there was no indication that they did.

Although the translocation was unsuccessful in establishing a wild breeding pair, several important lessons were learned from the effort. First, field biologists demonstrated that individuals of the species could be safely manipulated. Subsequent sightings of the translocated bird indicated that it was not adversely affected by its handling, transport, and temporary captivity. Second, the bird showed signs of potential positive acclimation to captivity, reacting passively to its holding cage and readily consuming foreign food. Third, information gained from observations and radio-telemetry was used to refine estimates of the birds' home ranges (Sparklin et al. 2003). Efforts to recapture these birds for future recovery initiatives will benefit from this new information.

NEED FOR A NEW STRATEGY

On June 25, 2002, representatives of the USFWS, Hawai'i DLNR, Maui Forest Bird Recovery Project, Zoological Society of San Diego (ZSSD), and the Hawaiian Forest Bird Recovery Team convened on Maui as the Po'ouli Working Group to discuss the next step in attempting to recover the Po'ouli. Several alternatives from the original EA were discussed, in-

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cluding another translocation attempt, placing the birds in a field aviary in Hanawi, removing the birds from the wild and placing them in captivity, or taking no further action. In addition, a new alternative was introduced which called for the birds to be placed in a field aviary at a more accessible location. It was clear that there were risks associated with all the options and that the chances of success were low no matter what alternative was chosen. Each option appeared to have advantages and disadvantages, and the decision was extremely difficult. No alternative was universally supported. A structured decision-making process was used to help evaluate and compare the alternatives based on the best available information and expertise. Although most agreed that the first translocation attempt was worthwhile, a second translocation attempt was rejected because available evidence indicated that adult Hawaiian forest birds have high site fidelity and usually return to their own home range following translocation (Fancy et al. 1997, Fancy et al. 2001, Groombridge et al. in review a), and there was no reason to suspect a female Po'ouli to behave differently. The two options that were judged to have the highest probability of success were removal to captivity and a field aviary in a more accessible location. Based on the results of the decision process, consensus eventually was reached within the USFWS and Hawai'i DLNR, the two agencies mandated to recover the species, to capture the three known birds and remove them from the wild for captive breeding. The factors that ultimately were judged to favor removal to captivity over a field aviary were that removal to captivity could be implemented more quickly, which was considered important given the advanced age of the three birds, and that it would be more difficult to provide adequate veterinary care in a field aviary and ensure the safety of birds from predators, severe weather, and vandals. In a letter to the USFWS and Hawai'i DLNR dated September 26, 2002, the ZSSD expressed with reservations that they would undertake the difficult task of attempting to manage and breed the Po'ouli in captivity at the Maui Bird Conservation Center. Captive breeding programs for Hawaiian forest birds operated by ZSSD at the Keauhou Bird Conservation Center and the Maui Bird Conservation Center have been very successful (Kuehler et al. 2000, 2001), but establishing a successful program with just a single breeding pair will be the ultimate avicultural challenge. Moving the birds to a field aviary or releasing them back into the wild together following pair-bond formation are still options if the birds do not breed in captivity.

CAPTURE, TRANSPORT, AND ACCLIMATION PROTOCOLS

In January 2003, the USFWS approved a permit request and a detailed protocol submitted by the Hawai'i Division of Forestry and Wildlife to capture the three known Po'ouli for the purpose of establishing a captive propagation and reintroduction program at the MBCC. The agencies involved in this effort recognize that there are risks involved in any attempt to capture wild birds and transport them into captivity. In light of the extreme rarity of the Po'ouli, strict operational guidelines were and will continue to be followed throughout the capture effort to ensure that these risks are addressed and mitigated to the fullest extent possible. Below is a brief summary of the some of the

guidelines, precautions, and protocols specified in the terms of the permit. Further information and protocols for the Po'ouli capture effort are available on the Internet at <http://www.dofaw.net/fbrp/projects.php>, or from the USFWS and Hawai'i DLNR upon request.

A qualified avian veterinarian will be present during all phases of the field operation, including mist-netting, transport, and acclimation of the Po'ouli. The avian veterinarian will be responsible for all aspects of bird care during the operation, including medical treatment if necessary. Two field veterinary units will be set up at each capture site to maximize the ability to care for an injured bird in the field. One unit will be maintained at the camp and will be fully equipped with an avian intensive care unit (AICU), consisting of a field aviary with rain shelter, a generator, adequate food supplies for 3 days, supplemental heat and light sources, supplemental oxygen supply, and a standard field avian veterinary care kit. A second, smaller unit will be maintained at the banding station and will be equipped with facilities and supplies necessary to give immediate, temporary care to an injured bird.

In the event of a Po'ouli mortality, analysis will be undertaken to determine the cause of death and identify additional operational procedures to correct the problems. Steps will be followed to preserve the cell line, conduct a necropsy, and prepare a skin for museum preservation.

Targeted Mist-netting Effort

The three known Po'ouli will be captured and removed from Hanawi NAR one at a time. The decision to have on-site veterinary care during all phases of the capture effort precluded the possibility of simultaneous mist-netting operations due to the distance between home ranges. Updated home range estimates for the HR1 and HR3 birds resulting from the 2002 translocation were used to optimize mist net placement. In October 2002 the HR2 female was seen for the first time in over two years. The capture effort in HR2 will be concentrated in the vicinity of this most recent sighting. Mist nets will not be operated during inclement weather that would prevent helicopter transport.

The targeted mist-netting effort also will take advantage of the close association between Po'ouli and Maui Parrotbills. Playbacks of recorded Parrotbill calls will be used strategically to attract Parrotbills and Po'ouli into the netting areas. Radio transmitters may be attached to specific Maui Parrotbill individuals known to associate with the Po'ouli, should these Parrotbills be captured. Radio tracking of such birds may help to update information on the locations and movement patterns of the Po'ouli. Visual confirmation of the Po'ouli's movements may also help to optimize mist net placement.

Post-Capture Procedures

Following capture and removal from the net, the bird will be placed immediately in a cloth bird bag for transport to a centralized, sheltered banding station located no more than 250 meters from the site of capture. The Po'ouli will be handled only by qualified persons on the proper Federal and State permits. Processing will be in accordance with guidelines of the Draft North American Bird Banding Manual (Gustafson et al. 1997), and the Draft Hawai'i Bird Banding Standard Operating Procedures (USGS, USFWS, and DLNR in prep.). Additional special procedures will include, 1) weighing of the bird immediately

after its arrival at the banding station (in the carrying bag) before being transferred into the transport container in order to establish the baseline to monitor future weight loss/gain, and 2) collection of feces from the bird bag for clinical evaluation of baseline gut fauna.

Each Po'ouli then will be transported on foot to a cloth-sided holding cage near each Po'ouli home range. Transport by hiking did not have any apparent adverse effects on Maui Creepers during surrogate tests (Groombridge et al. in review a), nor on the Po'ouli during the 2002 translocation (Groombridge et al. in review b). The cage will be set up within a secure screen tent erected in close proximity (no more than 100m) to a predetermined helicopter-landing zone. Once inside the cloth-sided cage, the Po'ouli will undergo a 3-hour acclimation period during which the on-site avian veterinarian will evaluate each bird's suitability for helicopter transport. During the three-hour acclimation period, the Po'ouli will be offered a variety of native and supplemental foods following recommendations of the ZSSD, including mealworms, waxworms, *Succineid* snails, and native insects. In the event that sudden changes in weather conditions prevent helicopter transport, field crews will be prepared to give full care to the bird for up to 3 days. Under these circumstances, additional food items such as egg, native berries, fresh fruit, and pet food will be added to the diet.

ACCLIMATION CRITERIA

Po'ouli will only be removed from Hanawi if they meet specific acclimation criteria during a 3-hour observation period overseen by the avian veterinarian. Birds that do not meet these acclimation criteria, but are otherwise healthy, will be bled for further genetic analysis and DNA preservation, then released. Birds that do not meet these criteria, but are physically compromised, will be held for further treatment by the avian veterinarian. A decision as to whether an individual bird will be flown out of Hanawi after capture will be made by the on-site veterinarian and will be based on multiple factors, including percent body weight lost/gained during evaluation, food consumption, number and character of droppings, body fat score at time of capture, and time of day of capture. A bird may be considered an unsuitable candidate for transport and long-term captivity if it has: lost > 15% of its initial body weight; consumed < 1.5 grams of food per hour of acclimation; or produced < 1.5 droppings per hour or > 35% of its droppings have a uric acid component > 75%. Birds with higher body fat scores (3 or higher) and those captured in the mid to late afternoon that have been feeding throughout the day have greater energy reserves than birds with lower fat scores and those captured early in the morning, thus potentially affording a longer adaptation period.

Helicopter Transport

If a bird successfully meets the acclimation criteria during the 3-hour observation period, it will be considered a candidate for helicopter transport out of Hanawi. Once there is confirmation of an inbound helicopter, the bird will be removed from the holding cage and transferred into a padded, noise-dampening, mosquito-proof flight box. The flight box was developed and used successfully for an earlier test of the feasibility of helicopter transport of Hawaiian honeycreepers (Greg Massey, pers. comm.). Each bird will be flown via helicopter directly to the MBCC, where it will be cared for by ZSSD staff.

RESULTS OF INITIAL CAPTURE EFFORTS

A series of six eight-day trips was planned from February-April, 2003, during which 1389 net-hours of mist-netting was conducted in HR1 on 22 days. Field crews stayed in Grasslands camp and New Greensword Bog camp through the cooperation of Haleakala National Park. The female Po'ouli was observed 12 times on 9 days, and twice was nearly captured using playbacks of Maui Parrotbill fledgling begging calls. Unfortunately the female Po'ouli appeared to be aware of the mist nets and was able to avoid them, and she was not caught. However, these mist-netting efforts resulted in the capture and banding of 256 birds of 9 species, including 5 Maui Parrotbills. Information gained from these banded birds will aid research on the overall ecology and management needs of the forest bird community at Hanawi.

Adverse weather severely hampered the capture effort. One trip was cancelled entirely due to weather conditions that precluded helicopter flight, and mist-nets were opened on only 22 of the scheduled 42 field days. For comparison, during mist-netting efforts for the translocation in 2002, it took 42 days of mist-netting to capture a Po'ouli, so the failure to capture a Po'ouli during the recent series of trips is not totally surprising.

We intend to conduct additional trips to Hanawi in fiscal year 2004 to continue efforts to capture the three known Po'ouli for the purpose of establishing a captive propagation and reintroduction program. The next trips likely will attempt to capture the male in HR3, in order to give the habitat in HR1 a chance to recover from any impacts, and to allow the female in HR1 time to resume movement patterns that might take her through mist-netting lanes that she was avoiding. Hopefully future trips will meet with better weather and improved luck.

OVERALL RECOVERY STRATEGY

The current recovery strategy for the Po'ouli must be based on the three known birds, not on vague hopes that more birds

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may be discovered in the future. With a known population of only three birds that are all at least six years old, the last documented breeding in 1995, and no known breeding pairs, the most urgent aspect of the recovery strategy for the Po'ouli must be to facilitate pair formation and reproduction among the three known individuals. Removing the birds from the wild for captive propagation is thought to be the best strategy for facilitating reproduction at this time.

The ultimate goal of recovery efforts is to release offspring of the remaining birds back into the wild and restore a self-sustaining wild population. It is therefore extremely important that the species' habitat continue to be protected and managed to ensure that reintroduction to the wild remains an option. Although much of the suitable habitat on east Maui has been surveyed for Po'ouli (Reynolds and Snetsinger 2001), due to the rugged terrain and cryptic nature of the species it is difficult to say with certainty that no more than three birds exist. Continued habitat protection and management also may benefit any wild Po'ouli that have not been located and are not part of captive propagation efforts. The scale of management should be increased through actions such as additional fencing, ungulate control, and aerial broadcast of diphacinone to control rats. Surveys for additional wild Po'ouli should be undertaken in order to provide more options for recovery. In the event of a death of a Po'ouli, various tissues should be collected for cell culture and possible future cloning.

ACKNOWLEDGMENTS

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Hakalau Forest National Wildlife Refuge

by Barbara Maxwell, Chief of External Affairs, US Fish and Wildlife Service Pacific Islands Office

From low sandy coral islets to high rainforests, the eleven National Wildlife Refuges in the Hawaiian archipelago support more than 55 threatened and endangered animal and plant species. Though each is special in its own right, perhaps the most unique is Hakalau Forest National Wildlife Refuge, the only high elevation tropical rainforest found within the Refuge System.

Though it's only a teenager in the National Wildlife Refuge System, the 32,700-acre Hakalau Forest National Wildlife Refuge on the island of Hawai'i stands among the leaders in endangered species recovery as we celebrate our centennial year. With eight endangered bird species, an endangered bat, and at least six endangered plant species, the refuge harbors one of the highest numbers of listed species within the System. But perhaps more remarkable is the progress the Refuge staff has overseen during its short history.

Hakalau Forest National Wildlife Refuge was created in 1985 to protect endangered forest birds and their rainforest habitat. Located on the windward slope of Mauna Kea between the elevations of 2,500 and 6,500 feet, the refuge contains some of the finest remaining stands of native rainforest in the State. However, at the time of purchase, the native forest merged into about 4,000 acres of open grassland at higher elevations, where rainfall decreases. The grassland area was forested 200 years ago, before cattle and ranching were established on the Big Island.

The staff's philosophy has always been that the best way to conserve Hawai'i's forest birds is to restore their habitat, so 16 years ago they embarked on a major habitat rehabilitation effort. Since 1987, more than 252,000 native trees have been planted on the refuge, including about 208,000 koa trees and more than 1,300 endangered plants.

"We've had tremendous support from the State's Division of Forestry and Wildlife, whose Waimea tree nursery propagated many of our koa seedlings, the U.S. Forest Service, the Big Island Resource Conservation and Development Office, AMERICAN FORESTS, and the Natural Resources Defense Council," said refuge manager Richard Wass. "The technical assistance, funding, and support these partners provided has energized our reforestation program."

An onsite greenhouse has supplied most of the planting materials since 1997, particularly the endangered species. The refuge horticulturist developed highly successful propagation techniques for *Clermontia pyralaria*, *Cyanea shipmani*, *Cyrtandra tintinnabula*, *Phyllostegia racemosa*, and *Phyllostegia velutina*, all listed species with four or fewer populations left in the world. *Clermontia lindseyana*, a less rare but still endangered species, also has been propagated from seeds found on the refuge and outplanted.

But Wass gives volunteers most of the credit for replanting efforts within the refuge. Led by refuge staff, volunteer groups from schools, Scouts, conservation organizations, and service clubs have been gathering seeds and planting native trees and shrubs for the past 15 years. Last year, 875 volunteers donated 6,344 hours of service to Hakalau Forest, making the long trek up Mauna Kea over rough four-wheel-drive trails to spend their weekend working.

Significant effort also has gone into alien species control. Forty-five miles of fencing have been installed and maintained, creating eight "feral ungulate management units." Feral and

domestic cattle (*Bos taurus*) have been completely removed from seven of those units, and only about six head remain in the eighth unit. Four units are pig (*Sus scrofa*)-free, and two others have low populations remaining. Feral ungulates are known to consume native plants, facilitate dispersal of alien plants, spread nonnative plant species, and cause erosion. Pigs in particular create breeding grounds for mosquitos (*Culex quinquefasciatus*), which carry avian pox and malaria B one of the primary threats to Hawai'i's native forest birds.

Eradication of invasive weeds such as gorse (*Ulex europaeus*), banana poka (*Passiflora mollissima*), and Florida blackberry (*Rubus argutus*) is another challenge faced by staff, contractors, and volunteers. To date, about 80 percent of the gorse has been removed from the refuge. The more accessible areas of the refuge are nearly "poka free," thanks to hundreds of hours of volunteer labor. And the area infested with Florida blackberry is shrinking, with the assistance of funding from the U.S. Forest Service.

But is it helping? Endangered species recovery is usually a slow, long-term process, so it is particularly gratifying to the refuge staff to see remarkable results over the past 17 years. Last year, they announced the first known sighting of an endangered forest bird – a juvenile 'akiapola'au (*Hemignathus munroi*) – within rehabilitated habitat on the refuge. The chick was heard calling from an area planted with koa trees in 1995. This year, the refuge biologist boasts that the staff now finds 'akiapola'au family groups in planted groves and corridors of koa on a regular basis.

A draft report on Hawai'i forest bird species modeling by the USGS Pacific Island Ecosystem Research Center released in 2002 offers more good news, at least for four species. Using data gathered since the mid-1970s, it concludes that the Hawai'i 'amakihi (*Hemignathus virens*) virens, not a listed species) population is widespread and sizable, with approximately 68,650 birds in Hakalau Forest. The rare 'akiapola'au population is very small, with about 800 birds within the refuge, but the population appears to be relatively stable.

For two other endangered forest birds, the Hawai'i 'akepa (*Loxops coccineus*) and the Hawai'i creeper (*Oreomystis mana*), the scientists found increasing populations over a 24-year period. About 5,000 'akepa and 9,100 Hawai'i creepers are thought to occur within the refuge. Results for nine additional forest birds species are expected soon.

"These endangered forest birds avoid open areas and even open forest canopy areas," explained Wass. "With less than 20 years of effort, we've demonstrated that recreating habitat for these species is possible. We have a long road ahead of us, but think of what could be here at Hakalau Forest for the Refuge System's tricentennial celebration!"

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Hawaii Audubon Society 2003 Awards for Student Research

by Wendy Johnson, Education Committee Chair

The Hawaii Audubon Society presented two awards for outstanding research relating to Hawai'i's natural history at the 46th Hawaii State Science and Engineering Fair. In early April representatives of the Hawaii Audubon Society's Education Committee joined other agency judges in studying the exhibits and interviewing students on the subject of their original research.

Melanie Kay and Katrina Morgan from Waipahu High School received the HAS Senior Division Research award for their project entitled "Determining Available food Supply for the Hawaiian Stilt at Pouhala Marsh." Working in muddy marshlands at the edge of Pearl Harbor, the students recovered samples of invertebrate organisms which support growing populations of endangered, endemic waterbirds. Melanie and Katrina worked long hours at the site, participating in clean-up activities before launching their natural history research. Birds were carefully counted and weather conditions were observed on a regular basis throughout the project. The students found ample variety and numbers of invertebrates in the shallow waters preferred by the stilts, but were not able to detect food organisms in the thick mud samples they collected. These findings led Katrina and Melanie to conclude that periodic dry-out of the area may not be beneficial for stilt populations. Both girls felt that common predators, like cats and dogs, pose the greatest threat to survival of the birds and their nests at Pouhala Marsh. The students are confident that planned construction of a fence surrounding the stilt habitat area will protect foraging and nesting birds.

The HAS award for outstanding Junior Division Research relating to Hawai'i's natural history went to a project submitted by Tiffany Kutsunai, a seventh grader at Kealakehe Intermediate in Kailua-Kona. Tiffany collected tiny red endemic shrimp from the anchialine ponds at Hualalai Resort on the island of Hawai'i for her research entitled "Got Shrimp? Got 'Opae Ula?." In two sets of controlled experiments, Tiffany studied the ability of the shrimps to survive in brackish water over a wide range of salinity. After four weeks, survival rates were excellent for all but the 100% sea water and 100% fresh water samples. Tiffany learned that this wide range of tolerance for varying salinities is critical to the survival of the 'opae ula in the unique environments in which they are found.

Special mention is warranted for continuing dedication to a bird species as represented by the Senior Research project submitted by Whitney Nekoba and entitled "Comparison of the Spring Departure Times of Pacific Golden Plover Wintering on O'ahu vs. Big Island." Whitney is an eleventh grader at Waiakea High School and was the recipient of an HAS Science and Engineering Fair Award in 1999. She has submitted outstanding work on the golden plover each year since then and received a small research grant from HAS in 2000.

Whitney plans to continue her research this summer on her second trip to Alaska for studies at plover nesting grounds. Whitney's original research reflects a compelling commitment to natural history in Hawai'i.

Field Trips for 2003

All trips with an * are still in the process of being planned. Details will be provided as the scheduled dates get closer. A donation of \$2 per participant on all field trips is appreciated.

'Aiea Loop Trail

May 24, Saturday

One of the best trails for upper-elevation forest on O'ahu. Possible to see 'apapane and 'amakihi. One of the best places to look for the elusive O'ahu Creeper, which has only been seen several times in the past two decades. Other birds include Japanese Bush-warbler and White-rumped Shama. The Guam Swiftlet has also been seen by several birders on one area of the trail. Plants may include 'ohi'a, koa, 'olapa, and 'ie'ie. About 4 miles round trip. Call the HAS office to register, 528-1432.

Left-Over Shorebirds & Ocean Creatures at Paiko Lagoon

June 14, Saturday 7-9:00 am

June 28, Saturday 7-9:00 am

See aquatic creatures such as eels, crabs, snails, mantis shrimp, squid, puffer fish, ghost crabs, and whatever else becomes visible. Wear old tennis shoes or reefwalkers, and bring sunscreen, water, and lunch. We will meet at Paiko Lagoon. Children especially enjoy this field trip! Call Alice to register, 538-3255.

Shorebird Homecoming at Paiko Lagoon

September 6, Saturday 6-8:00 am

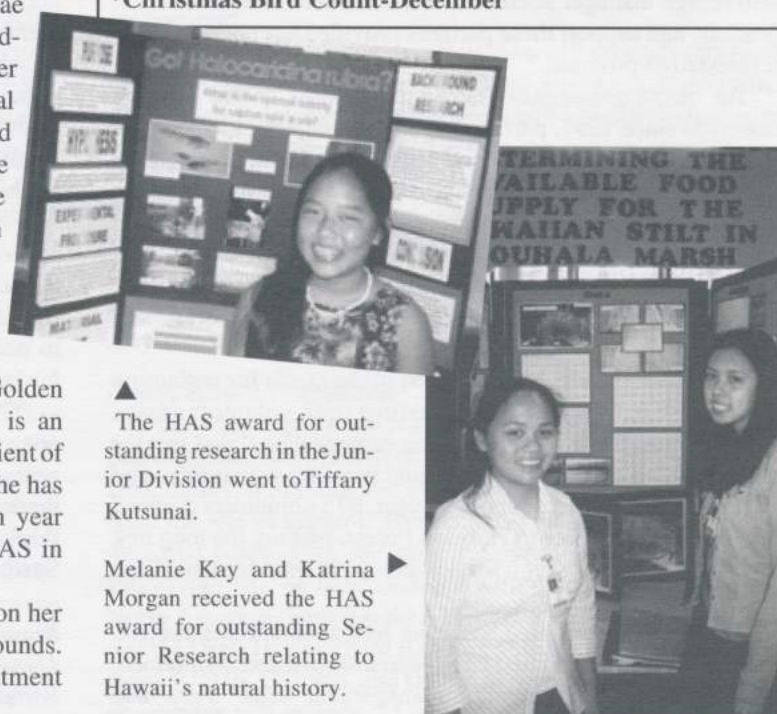
September 27, Saturday 9-11:00 am

Welcome our shorebirds home! Another great trip to Paiko Lagoon to welcome our Kolea home and see if other shorebirds have also returned. This is a keiki-friendly trip - the kids will love it! Wear old tennis shoes or reefwalkers, and bring sunscreen, water and lunch. We will meet at Paiko Lagoon at 8:30am. Call Alice to register, 538-3255.

*James Campbell National Wildlife Refuge-October

*Ewa Plains Sinkholes with Dr. Alan Ziegler-November

*Christmas Bird Count-December



▲ The HAS award for outstanding research in the Junior Division went to Tiffany Kutsunai.

▶ Melanie Kay and Katrina Morgan received the HAS award for outstanding Senior Research relating to Hawaii's natural history.

2003 Products and Publications Available from the Society

Hawai'i's Birds by the Hawaii Audubon Society, 5th edition, 1997. Over 150 color photographs and illustrations. \$12.95 per copy (\$9.95 plus \$3.00 postage and handling).

Voices of Hawaii's Birds by Douglas Pratt and the Hawaii Audubon Society, 1995. Two 60 minute tapes of songs of more than 100 species of birds found in Hawai'i. Includes a booklet. \$15.50 (\$12.50 plus \$3.00 postage and handling).

Hawai'i's Rare & Endangered Birds Notecards with artwork by renowned Island artist Patrick Ching. Eight greeting cards with envelopes. \$9.50 per box (7.00 plus 2.50 postage and handling).

Treasures of O'ahu Map A fun and informative self-guided tour of O'ahu including hiking, birding, and ancient cultural sites. \$5.00 (\$4.00 plus \$1.00 postage and handling).

The Edge of Forever The Society's 60th Anniversary Commemorative Poster by Richard Pettit. Now only \$10.00 (\$5.00 plus \$5.00 postage, mailing tube, and handling).

Elepaio logo patch \$3.75 (\$3.00 plus \$.75 postage and handling).

Checklist of the Birds of Hawai'i—2002 by R.L. Pyle. Lists all taxa naturally occurring in Hawai'i and introduced species that have established viable populations. \$3.50 (\$3.00 plus \$.50 postage and handling).

Checklist of the Birds of the Mariana Islands by James D. Reichel and Philip O. Glass, 1991. Lists all taxa naturally occurring in the Marianas and introduced species that have established viable populations. \$3.00 (\$2.00 plus \$1.00 postage and handling).

Checklist of the Birds of Micronesia by P. Pyle and J. Engbring, 1985. Lists all taxa naturally occurring in Micronesia and introduced species that have established viable populations. \$3.00 (\$2.00 plus \$1.00 postage and handling).

Field Card of the Birds of Hawai'i by R. L. Pyle and R. David, 1996. A pocket-sized field card listing bird taxa found in Hawai'i. \$.50 each. Call for postage price.

Hawaii Audubon Society logo t-shirts in white, natural, Pacific blue, jade, and gray, in sizes from S to XXL. Tank tops in white and grey, S to XL, same price. \$18.00 (\$15.00 plus \$3.00 postage and handling).

Send orders, with check payable to the Hawaii Audubon Society, to Hawaii Audubon Society, 850 Richards Street, Suite 505, Honolulu, HI 96813-4709. Products may also be purchased at the office to avoid mailing charges.

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Calendar of Events

- July 14, Monday, HAS Board meeting**
Open to all members, 6:30 to 8:30 p.m. at the HAS office.
Education and Conservation Committees meet at 5:45 p.m.
before Board meetings.
- June 16, Monday, Program Meeting Topic and Speaker in next issue.**
- May 24, Saturday, Field trip: 'Aiea Loop Trail**
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