

O`AHU NATIONAL WILDLIFE REFUGE COMPLEX

JAMES CAMPBELL NWR
PEARL HARBOR NWR
O`AHU FOREST NWR

Island of O`ahu, Hawai`i

ANNUAL NARRATIVE REPORT

Calendar Year 2002

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INTRODUCTION

The O`ahu National Wildlife Refuge Complex consists of the James Campbell NWR, Pearl Harbor NWR, and the O`ahu Forest NWR. All administration is accomplished through the Complex office located in Hale`iwa on the north shore of O`ahu. It takes about thirty minutes to reach any one of the refuge units from the office. Maintenance activities are primarily based out of the Ki`i Unit of the James Campbell NWR.

James Campbell National Wildlife Refuge

James Campbell NWR lies at the northernmost tip of O`ahu near the community of Kahuku and serves as a strategic landfall for native and migratory birds coming from as far away as Alaska, Siberia, and Asia. It is composed of two units - Punamano (37.5 acres) and Ki`i (107.5 acres). Punamano Unit is a natural spring-fed pond whereas the Ki`i Unit, a remnant of a formerly larger marsh, has been drastically modified by agriculture.

This large wetland was drained by a series of ditches designed to create terrestrial areas to be used for growing sugar cane. The Ki`i area was used as settling ponds to wash sugar cane at the Kahuku Sugar Mill. These ponds were used extensively by waterbirds. Closure of the mill resulted in the drying of these settling ponds. This prompted the Service to enter into a long-term lease agreement with the landowner, the Estate of James Campbell. The Refuge is currently managed by the Service under a 55-year lease; however, plans for land acquisition are underway.

The Refuge, under the lease agreement, was established in 1976 with the primary purpose of providing habitat for Hawai`i's four endemic, endangered waterbirds (Hawaiian stilt, coot, moorhen, and duck) and other native wildlife, as well as migratory waterfowl and shorebirds. Both units are located in a coastal area and the topography is nearly flat. Currently, wetland habitat is sustained at the Ki`i Unit by water from three artesian wells which is piped into seven impoundments. This Refuge is one of the most productive waterbird wetlands for resident and migratory species on O`ahu. A total of 102 bird species have been documented on the Refuge since its creation.

Pearl Harbor National Wildlife Refuge

Freshwater wetlands have been severely reduced on O`ahu so when shorebird habitat was to be destroyed for the construction of the Honolulu International Airport Reef Runway, lands were sought for mitigation. With the cooperation of the Federal Aviation Administration, the State of Hawai`i, the U.S. Navy, and the U.S. Fish and Wildlife Service, Pearl Harbor National Wildlife Refuge was established in 1972 on Navy land. The Service, under a use agreement from the Navy, manages two wetland units, the Waiawa Unit (24.5 acres) on the Middle Loch of Pearl Harbor and the Honouliuli Unit (37.4 acres) on West Loch of Pearl Harbor.

These two wetland units are extremely valuable. They provide habitat for Hawai'i's four endangered waterbirds (Hawaiian stilt, moorhen, coot, and duck) and serve as winter havens for migratory waterbirds. Waiawa is comprised of two man-made ponds with water pumped in from a nearby spring. It empties into the harbor. Honouliuli is also comprised of two man-made impoundments and water is pumped in from an on-site freshwater well. Though these units are small, they provide a variety of wetland habitat which makes them extremely important to the overall population of the four endangered waterbirds and to migratory waterbird species on O`ahu. The refuge has documented 83 species of birds.

A newer unit established under Pearl Harbor National Wildlife Refuge is the Kalaeloa Unit, formerly part of the Barbers Point Naval Air Station. It was transferred to the Service on January 30, 2001, and consists of 37.4 acres of dry land coastal habitat located on the leeward side of the island. It comprises the largest native remnant stand of the endangered *Achyranthes splendens* var. *rotundata* and supports other native coastal plants.

O`ahu Forest National Wildlife Refuge

On December 21, 2000, a total of 4,525 acres were purchased from Castle and Cooke, Inc. (via The Nature Conservancy), establishing the O`ahu Forest National Wildlife Refuge. The refuge, located on the upper slopes of the misty northern Koolau Mountains, contains at least nine native natural communities including lowland mesic forests, rainforest communities, high elevation cloud forest, and freshwater streams. The purchase allows the Service to protect some of the best remaining native forest in the northern Koolau Mountains and is the only area within the entire mountain range that is set aside for the primary purpose of resource management.

Within the refuge boundaries, the Service plans to implement conservation measures to perpetuate and enhance native flora and fauna and protect and recover endangered or threatened species. Koa and `ohi`a forests within the refuge support a rich diversity of native plants and animals including at least four species of endangered O`ahu tree snails, 17 endangered plant species, and one endangered bird, the O`ahu `Elepaio. Many other rare native flora and fauna species including native honeycreepers will also benefit from the protection and enhancement. Many of these native plants and animals that once thrived in these forests are either extinct or on the brink of extinction, and management intervention is needed to stabilize native ecosystems and prevent more species from becoming extinct.

INTRODUCTION

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Koloa

A. HIGHLIGHTS

- ▶ Weather stations greatly improved with GOES (B.)
- ▶ Expansion of the James Campbell NWR progressing (C.1.)
- ▶ Study funded to determine key predators of stilt chicks (D.5b.)
- ▶ RONS provide funds for maintenance position (E.1.)
- ▶ Volunteers help out in many ways (E.4.)
- ▶ It was a great year for badly needed projects (E.5.)
- ▶ MOU with Ducks Unlimited provides for multiple improvements (F.2. & I.2.)
- ▶ O`ahu Forest partners help to fund projects in the new refuge (F.3.)
- ▶ Kalaeloa Unit to be restored thanks to WUI funds (F.6.)
- ▶ James Campbell NWR Fire Management Plan approved (F. 9.)
- ▶ Five new bird species added to refuge bird list (G.1.)
- ▶ Overlook planned for Honouliuli Unit of Pearl Harbor NWR (H.6.)
- ▶ Long overdue baseyard facility approved and underway (I.1.)
- ▶ Essential water secured for wetland management at the Waiawa Unit (I.1.)
- ▶ New equipment greatly improves habitat management (I.4.)



Hawaiian Stilt

B. CLIMATIC CONDITIONS

Near Perfect Weather Year Round - Weather on O`ahu is very consistent, with only moderate changes in temperature throughout the year. This is possible due to the year-round warm sea surface temperatures, which keeps the overlying atmosphere warm as well. In practical terms there are only two seasons here: the summer months (called *Kau*) that extend from May to October and the winter months (*Ho`oilo*) that run from November to April. The average day-time summer temperature at sea level is 85 degrees F. while the average day-time winter temperature is 78 degrees. Night-time temperatures are approximately 10 degrees F. lower. In the higher elevations of O`ahu, there is a 3.5 degree drop in temperature for every thousand-foot rise above sea level.

There are as many different climate zones in Hawai`i as exist along the entire American coast from Alaska to Costa Rica. These islands can be described as an incredibly diverse collection of many microenvironments, each possessing unique weather, plants, and animals. Through most of the year Hawaiian weather patterns are affected primarily by high pressure zones in the north Pacific that pump relatively cool, moist trade winds down onto the island's northeastern slopes. This pattern holds true for most of the summer and approximately half of the time in the winter. These winds are forced up-slope by the mountain heights where ultimately their moisture condenses into clouds that produce rain. Most of the rain then falls in the mountains and valleys on the windward (northeastern) side of the islands. It is this weather phenomenon that creates the rich tropical environment and why weather can vary considerably across the island. The dry leeward side of the island averages only 25 inches of rain annually while the upper slopes in the mountains just five miles away received an average of 158 inches of rain annually. The wettest months are from November to March.

James Campbell National Wildlife Refuge - Ki`i Unit

Weather Statistics - 2002

Month	Average High Temp F.	Highest Temp	Average Low Temp F.	Lowest Temp	Total Rainfall
January	77.4	83.8	68.9	59.9	5.18
February	75.4	81.0	68.1	62.8	1.09
March	76.6	82.2	68.5	58.8	1.04
April	79.6	83.7	69.8	60.4	2.98
May	79.8	82.2	72.0	66.4	4.17
June	81.8	82.4	74.5	72.1	0.84
July	82.3	83.7	74.4	72.1	0.99
August	83.2	84.4	76.1	73.4	0.42
September	82.6	84.6	73.7	67.1	0.81
October	81.7	85.5	74.9	67.3	3.51
November	80.1	84.2	71.6	65.8	(1.86)*
December	78.5	82.0	69.8	62.6	(0.0)
Year					(22.89)

* Parentheses indicate some data lost due

Rainfall for James Campbell was still below normal of about 26-28 inches. This year continues a multiple year drought. This adds to the overall water deficit particularly during the summer months when water management becomes extremely critical as associated with stilt nesting. The new well going in at Ki'i should help to alleviate this problem.

In April 2002, the Ki'i unit FTS automated fire weather station now includes the Geostationary Operational Environmental Satellite (GOES) automated weather system which regularly transmits via satellite to a mainland US data collection center where it is available for use in fire weather observations. This FTS system, with a remote dial-in, has proven to be very reliable and user friendly. Remote dial-in allows us to instantaneously evaluate weather from the office, which is very helpful, particularly on potential burn days. During the same process, the old tower mast was removed and the entire FTS weather system mounted on a more compact "lunar module" system.

**Pearl Harbor National Wildlife Refuge - Honouliuli Unit
Weather Statistics - 2002**

Month	Average High Temp F.	Highest Temp	Average Low Temp F.	Lowest Temp	Total Rainfall
January	80.1	84.6	67.3	58.6	4.13
February	78.0	86.2	66.2	59.2	0.57
March	79.3	83.3	66.3	57.2	1.49
April	82.5	85.1	68.4	60.8	0.80
May	83.3	87.8	71.1	67.5	3.50
June	83.4	86.0	73.3	68.9	0.19
July	83.6	88.5	73.8	70.2	0.19
August	85.0	88.0	75.0	70.3	0.28
September	85.3	87.6	73.0	68.4	0.01
October	84.1	86.7	72.7	66.2	2.98
November	83.0	88.0	69.8	63.9	1.26
December	81.8	86.9	67.4	61.5	0.09
Year					15.30

**Pearl Harbor National Wildlife Refuge - Waiawa Unit
Weather Statistics - 2002**

Month	Average High Temp F.	Highest Temp	Average Low Temp F.	Lowest Temp	Total Rainfall
January	81.7	86.2	66.5	59.4	5.43
February	80.6	86.9	64.7	59.2	0.64
March	82.4	86.2	65.2	57.0	2.65
April	85.7	88.5	67.1	58.6	0.38
May	85.9	90.5	69.9	65.7	3.38
June	88.4	90.1	72.3	68.2	0.20
July	88.1	92.5	72.8	69.1	0.30
August	89.4	92.3	74.0	71.2	0.14
September	89.4	91.6	71.9	67.1	0.01
October	87.7	91.4	71.8	66.6	3.17
November	85.3	88.5	68.6	61.9	1.78
December	84.6	87.3	66.8	60.8	0.04
Year					18.12

In November of 2001, both Pearl Harbor wetland units were upgraded to a FTS automated weather station. In August of this year, the tower masts of the FTS systems were also replaced by the "lunar module" support systems. Unfortunately, neither of the FTS weather systems are part of the regional fire weather system.

**O`ahu Forest National Wildlife Refuge
Rainfall Average**

Month	Average Rainfall (inches)
January	15.3
February	13.0
March	21.2
April	17.1
May	16.4
June	17.8
July	20.4
August	22.0
September	16.8
October	15.4
November	17.7
December	18.5
Annual	211.5 inches

Precipitation data for O`ahu Forest NWR is from Wahiawa Mauka Int 88, Honolulu, Hawai`i, height about 1210 feet above sea level. Source derived from 30 complete years between 1921 and 1958.

Although there is no weather tracking station within the O`ahu Forest NWR, the upper Wahiawa Mauka station number 88 is located at about 21.51oN 157.95oW and height is at about 1,210 feet elevation above sea level. This station is considered representative of average rainfall, at least in the lower elevations of the refuge. Rainfall gradients in the northern Koolau Mountains are relatively steep, and rainfall increases with increasing elevation. Moisture-laden clouds tend to form near the crest of the Koolau Mountains and the heaviest rainfall occurs at the summit or just to the lee of the summit.

C. LAND ACQUISITION

1. Fee Title

James Campbell NWR

The James Campbell National Wildlife Refuge is the premier endangered Hawaiian waterbird recovery area in the northern portion of O`ahu and supports all four endangered waterbirds, and a variety of migratory shorebirds and waterfowl. The two units that comprise the Refuge are separated by just under a mile and are presently managed under a 55-year lease from the Estate of James Campbell. The Fish and Wildlife Service is studying a final expanded Refuge boundary comprising a total of approximately 800 acres, all owned by the Estate of James Campbell. Acquisition will occur in three phases. Approvals and funding are in place for the Service to purchase fee title to 165 acres this summer. This would complete the purchase of land under lease and a 5-acre spring area.

The second phase is nearly complete: the Service is completing its planning work associated with a 160-acre addition to the Punamano Unit of the Refuge and expects to be able to purchase some of these lands before the end of this fiscal year. However, the purchase of the Ki`i and Punamano units have yet to take place. The purchase is still pending subdivision through the City and County Land Court which we hope will be completed in 2003. Appraisals and contaminants surveys have been completed for lands to be acquired. Completion of the second phase of land acquisition could allow the Service to move forward with planning for a headquarters and visitor center – facilities that would support Refuge administration and operations including visitor services and habitat management programs. No significant contaminants issues are anticipated in the second phase of land acquisition.

RM Stovall met with Regional surveyor Bill Drummond and the Service's contractor surveyors (R.M. Towill) along with Bert Hatton, a representative from the Estate of James Campbell, on August 20th to agree to boundaries of the first and second phase of the purchase. A Preliminary Subdivision map of the agreed boundaries was provided in November.

The final phase will be to complete additional planning and coordination with the local community to develop a final approved Refuge boundary that would encompass the remaining areas.

Local community support has been expressed for the Refuge and proposed additions, with a particularly high level of support from the conservation sector, educators, and birding enthusiasts. A few lessees who have a special interest in preserving their current life styles, and who would have to move if the land is acquired by the Fish and Wildlife Service, are expressing opposition to the purchase of land.

Based on our experience with public announcements about Refuge land acquisition proposals, the local community endorses phase one and two. Local residents who have been waiting for a long time for flood relief support the project. Letters from the Kahuku Village Association and the Kahuku Community Association were in support of the project in order to obtain flood relief. A few tenants and supporters of aquaculture have expressed concern. There are challenges from those individuals who wish to see the large shrimp farm commercial operation continue. The shrimp farm conflicts with endangered waterbird recovery and habitat enhancement. The commercial operation is based on pumping of salt water, which has an effect on the nearby natural freshwater wetlands.

In order to provide information on relocation to the tenants that could be affected by the proposed purchase, meetings with the Service's Relocation Specialist, Georgia Shirilla, were scheduled. Out of 14 tenants, all but one showed for the individual meeting. Ms. Shirilla discussed the provisions of the Relocation Act and learned about the specifics of each operation, including what personal property exists and if there were any particular relocation needs that would be applicable. Since determining the relocation benefits is a process, not all of their questions could be answered at this first meeting, but it was a good start toward ultimately determining eligibility, and answered many of their questions. Meetings were held at the Turtle Bay Resort over the week of January 28, 2002.

Several meetings listed below were held with the tenants and/or interested parties in addition to several community and neighborhood board meetings.

Date	With Who	FWS Participants	Purpose	Outcome
January 28 - Feb. 02, 2002	Individual Tenant Mtgs.	Georgia Shirilla	Relocation Benefits	Private Discussion regarding Relocation
January 31, 2002	Sen Inouye's staff	Donna Stovall Jerry Leinecke	Kahuku Flood Project	*Project justification (Ecosystem restoration) *COE report on Reconnaissance study *Roles/responsibilities of agencies
March 14, 2002	Koolauloa Neighborhood Board Meeting	Donna Stovall Phyllis Ha	Ecosystem Restoration / Flood Project Introduction	Information Only - no decision taken
March 22, 2002	Kahuku Solutions Group	Donna Stovall Jerry Leinecke	Organization of Group	Interests and Concerns, Process for solution identified
April 5, 2002	Follow up Kahuku Solutions Group	Donna Stovall Jeff Rose (RO)	Project Introduction	Agency/Individual Reports
April 17, 2002	Kahuku Community Assoc. Mtg	Donna Stovall Mike Silbernagle Jerry Leinecke	Introduction of Flood Project	No decision made by Board
May 30, 2002	JMCE meeting	Donna Stovall Jerry Leinecke	Sm group meeting with JMCE, Spencer, Makaiau	Land purchase proposal from Spencer, FWS did not accept
November, 14, 2002	Koolauloa Neighborhood Board Mtg. & Senator Inouye's staff	Donna Stovall Jerry Leinecke Phyllis Ha	Project overview	The Board requested additional time for the parties involved to come to an agreement before a decision will be made.

The Federal Government, most military reservations, is reported to own approximately 12% of the island of O`ahu. The full acquisition (800 acres) would not affect the percentage of Federal ownership on O`ahu. The impact on local tax revenues is likely to be minimal because the land is zoned for Agriculture, which has a relatively low tax base, and the Service's revenue payment would most likely approximate the tax payment.

2. **Easements**

The Estate of James Campbell is reserving five easements, primarily following the ditches thru the refuge in order to access the ditches as needed and to access other Estate lands in the surrounding area. The draft subdivision map was created by the Service's contractors, R.M. Towill, and was provided for review in November.

3. **Other**

Nothing to report.

D. PLANNING

1. **Master Plan**

Nothing to report

2. **Management Plan**

Benefitting the community of Kahuku and the James Campbell NWR, Senator Inouye is championing an Ecosystem Restoration Project that would combine with it a flood control project. This will benefit residents of Kahuku, area farmers, other residents of Hawai'i, visitors to Hawai'i, and Hawai'i's tourism industry. The project serves as an flooding abatement and enhancement of the surrounding flood plain for the restoration of habitat in order to aid in the recovery of endangered waterbirds. The new areas identified for refuge acquisition are critical to the flood control project. They will also provide essential wetland, coastal dune, and near shore habitat important to threatened green sea turtles, seabirds, endangered monk seals, and migratory waterbirds. Furthermore, the project will provide new opportunities to the public to view and learn about Hawai'i's wetlands. For more information, please refer to Section C.1.

3. **Public Participation**

Regarding the project proposing to purchase approximately 800 acres of land for the James Campbell National Wildlife Refuge, several meetings were held this year with the tenants and/or interested parties in addition to several community and neighborhood board meetings. Please refer to Section C.1.

4. **Compliance With Environmental and Cultural Resource Mandates**

Nothing to report.

5. Research and Investigation

- a. Waiawa Unit Ecological Risk Assessment Pearl City Peninsula Landfill - The Pearl Harbor NWR Waiawa Unit is located adjacent to a superfund site which is an old landfill of the U.S. Navy. There is concern that contaminants from this landfill are entering the refuge. An assessment is under contract (PACNAVFACENGCOM Contract No. N62742-98-D-1808) to determine the biological risk. Human health is also of concern due to Refuge staff potentially being exposed to a variety of contaminants.

In April, 2001, the Waiawa Unit Screening-Level Ecological Risk Assessment (SERA) was conducted to evaluate potential contamination entering the refuge. The following sources of potential contamination were identified: groundwater flow from an up-gradient landfill, seawater intrusion from Pearl Harbor, and freshwater pumped into the refuge from the Waiawa spring. Step 3a of the Navy's ecological risk assessment guidance involves a re-evaluation of risks predicted through the screening assessment. The step occurs prior to the collection of additional site-specific data and is used to eliminate chemicals of potential ecological concern. A draft Step 3a Evaluation report was submitted for review in December 2001. Based on comments from that report, chemicals designated for elimination were carried forward due to concerns regarding the process. There was a concern from the reviewers (EPA and FWS) that there was an underestimation of risk. A revision of the Draft Step 3a Evaluation was distributed in October 2002 which identified that all non-detected chemicals whose minimum detection limits exceed or lack benchmarks would be retained and evaluated in the baseline ecological risk assessment.

- b. Identifying Key Predators of Endangered Hawaiian Stilt Chicks - The disappearance of eggs and chicks of the endangered Hawaiian Stilt (*Himantopus mexicanus kudseni*), a waterbird endemic to Hawai'i, is assumed to be depredation caused by alien species such as mongooses (*Herpestes auropunctatus*), cats (*Felis catus*), Cattle Egrets (*Bubulcus ibis*), dogs (*Canis familiaris*), bullfrogs (*Rana catesbiana*), giant toad (*Bufo marinus*), and rats (*Rattus spp.*). These predatory species have plagued recovery efforts and their control within waterbird nesting areas is specifically identified in the Draft Hawaiian Waterbird Recovery Plan as a task needed to reach de-listing objectives. The objective of this study is to gather specific information on which predator(s) affect reproductive success of Hawaiian Stilts. This work will be done at the Ki'i Unit of the James Campbell National Wildlife Refuge (NWR), a long-term stronghold for Hawaiian Stilts. The hatching success is greater than 80%; however, chicks disappear without a trace within the first two weeks after hatching. Our proposed project would involve observation monitoring of active Hawaiian Stilt nests and chicks, as well as surveys for

potential predators. If chick mortality occurs, cause of death, habitat, and life stage of the bird will be documented. The results of this study will help focus predator control efforts on specific predator(s), evaluate the predator management program, contribute to the conservation of this species, and better define the role predators play in the recovery of Hawaiian waterbirds. Methods and solutions will be applicable to endangered waterbirds statewide.

Exotic predators are serious threats to Hawaiian waterbirds. Known or suspected predators include rats, domestic dogs and cats, Indian mongoose, cattle egrets, common mynahs (*Acridotheres tristis*), black-crowned night-herons (*Nycticorax nycticorax hoactli*), giant toads, and bullfrogs. Humans introduced most of these species to this once predator-free insular ecosystem.

Our current data from the James Campbell NWR show a high rate of Hawaiian Stilt nesting and egg hatching, but poor survival in the first two weeks after hatching. For the first three weeks after hatching, stilt chicks cannot fly, so they depend on cryptic behavior to avoid predators. Predators likely drive our observed disappearances, but with the plethora of predators, it is difficult to identify which are responsible for the majority of deaths. Consequently, Hawaiian Stilt management is hindered because predator control measures are species specific, and we do not know which species to target. For example, fencing to exclude dogs will not affect resident bullfrogs or giant toads, and mongoose traps will not catch Cattle Egrets.

The tools of predator control and exclusion are well developed for some species, but not for others. In Hawaiian wetlands, predator control and exclusion have focused primarily on mongooses and dogs, with demonstrated benefits. For example, in 1980 dog control via chain-link fencing at the Waiawa and Honouliuli Units of the Pearl Harbor NWR resulted in 10% less egg predation compared to Ki`i and Nuupia where there was no fencing (Coleman 1981). Two problems exist for predator control on Hawaiian wetlands: identifying which predators are most detrimental and deciding on the most appropriate species specific method for dealing with them. It is too costly and impractical to continually exercise control measures for all predators, in part because each predator has very particular approaches required for its control. In addition, effective control measures have not been developed for some predators. Consequently, it is critical to identify key predator(s) to enact effective predator control.

The goals of the study are to (1) monitor nesting success at the Ki`i Unit of the James Campbell NWR, (2) census potential Hawaiian Stilt egg and chick predators using taxon particular protocols, and (3) identify which predator(s) is causing the most problems for Hawaiian Stilts. Subsequently, effective

predator controls will be developed and enacted, and the results on nesting success monitored.

Because potential predators include birds, mammals, and amphibians, we will require several types of predator survey techniques. Surveys will be conducted throughout the breeding season, and correlated over time with egg and chick disappearances. If depredated eggs or chicks are found, the remnants and surrounding ground will be studied for evidence of the predator's identity. Surveys will begin in early March 2003, and continue until most chicks have fledged by late September. Dr. Michael Reed, who has a long history of applied research on Hawaiian stilts will assist refuge staff with the coordination of this project.

- c. Hawaiian Silversword - Claremont University Graduate Student Mitchell McGlaughlin (information provided in his proposal is provided) - Mitchell McGlaughlin was issued a Special Use Permit to collect one of the Hawaiian Silverswords, *Dubautia laxa*, from the Kipapa Gulch within the O`ahu Forest National Wildlife Refuge. As part of his doctoral thesis, he is examining the inter-island population genetics of *D. laxa* throughout the Hawaiian archipelago. Due to its wide distribution throughout the Hawaiian archipelago, *D. laxa* is ideal for studying the genetics of inter-island dispersal events, the effect of breeding system on dispersal and colonization, and the impact of population isolation on genetic structure. Because limited work has been conducted with this species, this study will also provide information useful for a current status review. Number and location of extant populations, number of individuals within a population, major threats to specific populations and the species as a whole, and information about pollinator visitation will be gathered. These data will prove useful for recovery and management of the taxa. In addition, the genetic data will allow an assessment of the inter-relationships of sub-species, which occur in the refuge. To carry out this work, microsatellite markers developed specifically from Hawaiian silverswords (Friar et al., 2000) will be used, as well as DNA sequence data from several low-copy-number nuclear genes and introns. The genetic data will be used to calculate genetic diversity statistics, produce estimates of gene flow among populations, and to estimate when dispersal and speciation events took place. In addition the breeding system of *D. laxa* will be investigated by conducting crosses with cuttings grown in a greenhouse environment. These plants are long-lived, low growing, multistemmed shrubs and subshrubs in the Asteraceae (Sunflower family).

Dubautia laxa is endemic to volcanic slopes on the Hawaiian Islands, and is represented by two common and two rare sub-species. *D. laxa* ssp. *laxa* is found on the islands of O`ahu, Molokai, and Maui. *D. laxa* ssp. *hirsuta*

(Hillebrand) Carr, is found on the islands of Kauai, O`ahu, and Lanai. Both *D. laxa* ssp. *pseudoplantaginea* (Skotts.) Carr and *D. laxa* ssp. *bryanii* (Sherff) Carr are endemic to the island of O`ahu.

This study is to be accomplished by sampling multiple populations of *D. laxa* on all of the islands on which it occurs. The size of each population will be determined prior to sampling, to ensure an even distribution of samples taken. Any threats to a population will be noted and reported to land managers. All sampling will be conducted in a non-destructive manner, by removing a few leaves from the plants, which are multi-stemmed shrubs to sub-shrubs. Up to five grams of leaf tissue will be collected from 30 individuals in each population sampled. Collected leaf samples will be shipped on ice to Rancho Santa Ana Botanic Garden where they will be stored at -80°C until DNA can be extracted. All tissue collected will be consumed in the genetic analysis. After completion of genetic analyses, the data will be analyzed using traditional population genetic measures to examine levels of genetic diversity, within species and sub-species population divergence, the timing of dispersal/founder events, and the impact of breeding system of population-level genetic structure. The final product of this research will be the completion of his Ph.D. thesis, which requires that this data be published in a peer reviewed scientific journal. The refuge will be sent a final copy.

This project has potential conservation implications for both the local reserve and the species as a whole. Primarily, documentation of population location and population size will lead to more informed management. Second, genetic data has the potential to identify populations/areas that are more divergent, warranting greater conservation priority. Additionally, there are several morphologically recognized sub-species of this species of *Dubautia*, but we are currently unsure if they are genetically distinct entities.

The Kipapa Gulch region is one of the most interesting areas where *D. laxa* is found. There are three sub-species of *D. laxa* that are recognized in the Koolaus, *D.l.* ssp. *laxa*, *D.l.* ssp. *bryanii*, and *D.l.* ssp. *pseudoplantaginea*. Kipapa Gulch is the only locality where all 3 sub-species have been collected in close proximity. Collections made of *D. laxa* from Kipapa Gulch will allow for an assessment of how distinct the various sub-species are, and will address questions related to speciation events. The Kipapa Gulch and the larger area encompassed by the O`ahu Forest National Wildlife Refuge is one of the most important regions of diversity for *D. laxa*, making it important that it is incorporated into our understanding of the larger genetic framework of this species. *D. laxa* is a perennial, multi-stemmed shrub to sub-shrub. Collections of leaf tissue do not require the removal or destruction of any one stem, so it does not significantly impact future growth and flowering.

A Special Use Permit was issued to Mitchell Mcglaughlin for October 14-15 for the O`ahu Forest NWR. ARM Hoffman and Keahialaka Balaz guided him to the Koolau summit where the plant was found and collected. A report was submitted to the Refuge office in December 2002. The entire study will be completed in June 2005.

6. Other

Nothing to report.

E. ADMINISTRATION

1. Personnel

Minimum staffing needs identified for the Complex is 15 PFT personnel. Although we are trying to become more efficient by acquiring better equipment, working with volunteers, and contracting labor, every habitat related task on each of our refuges is very time intensive. This makes personnel our number one resource.

The O`ahu NWR Complex consists of the following staff members:

Name	Title	Grade	EOD	Status
Donna Stovall	Refuge Manager	GS-13	10-12-1997	PFT
Nancy Hoffman	Assistant Manager	GS-11	08-05-2001	PFT
Michael Silbernagle	Wildlife Biologist	GS-12	10-01-1992	PFT
Pamela Gibson	Admin. Support	GS-07	09-23-2001	PFT
George Fisher	Tractor Oper. -Sup	WS-04	10-24-1999	PFT
Gregory Smith	Tractor Operator	WG-06	04-25-1994	PFT
Maurice Blackwell	Tractor Operator	WG-06	07-04-1999	PFT
Jeffrey Albeso	Tractor Operator	WG-06	06-08-1997	Term
Vacant	Biologist			
Keahialaka Balaz	Biologist		11-04-2002	Contract



Left to right: Pamela Gibson, Keahialaka Balaz, George Fisher, Michael Silbernagle, Nancy Hoffman, Donna Stovall, Greg Smith, Maurice Blackwell, and Jeffrey Albeso.

Personnel is critical to our mission here in Hawai`i. The State's vast invasion by nonnative plants greatly reduced the quantity and the quality of habitat and has become a very serious threat to four species of native endangered waterbirds. This primary problem we face creates a habitat maintenance program that is extremely labor intensive. Control efforts are further encumbered by a 12-month growing season. Some relief was provided in helping us combat this problem through a RONS package #00003 in FY02 which enabled us to convert a non-core maintenance position to a core position.

Tractor Operator Maurice Blackwell, who is instructing volunteers on mangrove removal, was added to O`ahu's CORE staffing chart.



As the Pacific Islands representative, Maintenance Supervisor George Fisher was selected to serve on the Region 1 Wage Grade Committee, which will function in an advisory capacity to the Regional Director with respect to generic issues of concern of wage grade employees. The initial meeting was held in Portland, November 7-8.

The four wage grade personnel (Fisher, Smith, Blackwell, and Albeso) participated in the first regional Maintenance Workshop on April 29 through May 2 at Malheur NWR in Oregon. Each worker came back impressed with the program and enjoyed the opportunity to see a mainland refuge.

Jeffrey Albeso was extended for another term position as a Tractor Operator. His new term started July 7, 2002. Our goals are to have a permanent position for Jeffrey as soon as funding will permit.

Keahialaka Balaz came on board November 4, under contract. Keahialaka, who grew up in this area, has an in-depth knowledge of the 4500 acre O`ahu Forest NWR. The area is extremely remote, rugged, and has no vehicular access, making his knowledge of terrain critical in order to efficiently and effectively carry out initial field activities. This capability combined with his broad informational background of native and endangered species, locations of these species within the project site, native plant propagation skills, ability to remove feral ungulates, and a positive report with the local hunting community enable him to carry out many duties and assignments that would otherwise require several individuals with each of his specialized skills. He had been working with The Nature Conservancy as a field technician. We also hope to hire him as a biologist in the future, as funding permits. Funding for this contract was with the aid of Ecological Services, which are also helping to fund monitoring and restoration projects within the O`ahu Forest refuge and the Koolau Mountain watershed.

Wage grade personnel Albeso, Blackwell, and Smith, and wage supervisor Fisher attended Forklift Operator training through EnvironServices and Training Center, Leeward Community College. This was held at the Ki`i Unit on January 24.

RM Stovall traveled to Portland for a meeting on February 12th. She was requested to participate in a Cross Program Focus Group to share any suggestions or issues regarding communication and information that is shared between programs horizontally and across regions as well as vertically between field offices, headquarters, Department, and with customers/partners.

AOA Gibson attended the Administrative workshop in Honolulu February 26-28. The workshop was presented by Regional personnel.

RM Stovall and ARM Hoffman attended Endangered Species Implementation Training in Hilo on the Big Island, March 18-22. This was a NCTC sponsored course.

The staff participated in a Team Building course taught by Loren Lasher of Potential Development, Unlimited on the 11th of March.

RM Stovall and ARM Hoffman attended the Project Leaders meeting April 22-26 in Portland. Prior to the meeting ARM Hoffman also attended the NCTC course on Coaching.

TO Blackwell was on Military Leave during July 14-27.

RM Stovall participated in a MMS funding strategy held in Portland on July 30th. This was a proactive response to the anticipated delay of the passing of the Service's FY03 budget.

AOA Gibson attended FSS training in Portland October 16-18.

ARM Hoffman attended the Basic Refuge Academy October 21 through November 15 which was held at NCTC. She now can yell "REFUGES" louder than anybody on staff.

RM Stovall and WB Silbernagle attended a Hawai'i Wetland Seminar over October 31- November 1 which was sponsored by the FWS. Both made presentations during the two day seminar.

2. Youth Programs

ARM Hoffman hosted a group with the Youth Conservation Corps (YCC) during July 22-26. After an orientation of the O'ahu NWR Complex, most of their time was spent at the Kalaeloa Unit of Pearl Harbor NWR weeding out invasive vegetation to make room for endangered Hawaiian plants as well as other natives historically common in that area. The last day



YCC outplanting native plants at Kalaeloa Unit.

consisted of a field trip into the O`ahu Forest NWR. They proved to be very dependable hard workers with excellent team leaders. It was well worth our effort to serve as a host. Other week-long hosts on O`ahu included The Nature Conservancy and the State of Hawaii Department of Land and Natural Resources.

Emily Hite was a volunteer for Midway during the summer through an internship program from the University of Pennsylvania. Unfortunately, the Midway position fell short three weeks prior to the end of her term for school credit, so she finished up at O`ahu. Emily was able to jump right in first assisting ARM Hoffman supervising the YCC crew, helping with data entry, and filling in where needed. She was a very quick learner, and we were happy to host her from July 15 through August 2.

3. Other Manpower Programs

Nothing to report.

4. Volunteer Programs

We were able to acquire two mobile homes (8' X 30') model 2002 through FEMA. They were located in Houston, Texas and cost close to \$9,000 each to ship to O`ahu, but it will be funds well spent. We constantly have offers of long-term volunteers if housing can be provided; with no housing, they have to look elsewhere. These trailers (one of which will be transferred to Maui NWR Complex) will be used to house volunteers and research students at a cost savings to the government. Once the maintenance building is completed, we will be able to hook the trailer to water, sewer, and electricity to comfortably house two volunteer with the capability of sleeping six for short periods of time. The original acquisition cost was \$15,000.



FEMA trailers to be used for volunteers. A great find thanks to volunteer Lloyd French who passed the message out to Refugees.



Both trailers were in "new" condition and will be perfect for temporary stays.

A small group of very valued volunteers consisting of local birders are providing interpretation and excellent bird spotting during the guided tours at James Campbell NWR. Without their assistance, guided tours for the public could not be provided, so they are critical to our public use program.

Volunteer Kathy Hachey returned in October after time off to care for her mother. Though she has accumulated close to 2,000 hours of volunteer service overall, she was only able to put in approximately 183 hours this year, but is now back volunteering three days a week. Her services have been invaluable to the biological program. Her primary duties include waterbird surveys, nest monitoring, water manipulation, data entry, and GPS data collection.

Patti Gallagher-Jones joined our volunteer staff in December, coming to us from Midway Atoll NWR. Ms. Gallagher-Jones is a retired USFWS employee with a talent in graphic design and public outreach. Pattie contributes to our presentations to the public, data management, and fueling our creative juices at the Refuge. Without Patti's assistance, much of the work would have not been accomplished, due to lack of personnel resources.

Spearheaded by Bruce Koebele, PhD and Professor Frank Stanton, Leeward Community College students "volunteer" for restoration efforts at the Kalaeloa Unit of Pearl Harbor NWR through a biology course offered at the college. The students contribute time at "weeding and planting parties" once a month through the spring and fall semesters each year. The students and faculty at the college have participated in these restoration efforts for the last five years. They have been our primary labor resource at Kalaeloa, even prior to it being included as part of the refuge system. Including all volunteer assistance during the year, a total of approximately 245 volunteers participated in these service trips, contributing 858 hours of labor. Though the majority of these hours were contributed by Frank Stanton's students, volunteers from Wai'anae High School (Hawaiian Studies Program), Youth Conservation Core, Leeward Community College at Wai'anae, Nakamura-



Volunteer Bruce Koebele and student planting the endangered A'koko plant at the Kalaeloa Unit.

Gakuen College in Japan, Brigham Young University, The University of Hawai'i at Manoa, US Army Directorate of Public Works, Lyon Arboretum and Waimea Arboretum also contributed substantially to our efforts in 2002.

Hawaii Trail and Mountain Club has volunteered a considerable amount of their time to reclaim the original Civilian Conservation Corps (CCC) trail along the Kipapa Trail of the O`ahu Forest National Wildlife Refuge within the Koolua Mountains. About 25-30 club members join Refuge staff to cut, pull, chop, and slice alien plant species from the historic trail. They have opened the trail and re-contoured the path a total of seven miles into the Refuge. This badly needed effort not only provides further access into the "foot traffic only" refuge, it provides a safe passage.

Kersey Apfel volunteered one day a week for the summer months and assisted with data entry and waterbird surveys.

Emily Hite volunteered for us in July 2002 at the O`ahu National Wildlife Refuge Complex. Though Emily was available for only a few weeks, her assistance proved to be very beneficial to the staff and refuge. She helped supervise a youth group planting native, endangered coastal plants; she collected native seeds, conducted waterbirds surveys and brood counts, collected site data using Global Positioning System, participated in marine debris cleanup, and entered biological data.

Along with members of the Sierra club, the staff hosted a Catch the Drift and Bag It Day on September 21. With permission from the Estate of James Campbell, who also provided a trash dumpster for the trash, the volunteers picked up the debris from the beach dunes adjacent to the refuge and recorded the type and amount of each piece removed. It was a rewarding day for all.

Other valued volunteers include many weekend warriors willing to give up their time for a good cause to weed, pick up beach debris, and other various job tasks that are often times hard work, tiring, and just plain boring. Thanks to all.

5. Funding

Though our base funding was cut severely this year, MMS projects, equipment replacement, and "other funding" for special projects and studies made for a good year. One of the biggest thrills was to receive funding to construct a storage building which will give the maintenance staff a roof to work under and provide protection to their equipment from the direct coastal winds. After 26 years of existence, this will also provide basic utilities like water, electricity, and sewer to the baseyard, which eliminates several safety violations.

Funding Allocations - Fiscal Year 2002

1234 - 0000	Pacific Joint Venture	10,000
1261 - 0000	Base O & M	484,272
1261 - 110V	Volunteer	2,000
1262 - A114	Annual Maintenance	45,000
1262 - 1BCW	MMS - Building	279,300
1262 - 1BEC	MMS - Water Delivery	223,250
1262 - B114	Vehicle Replacement	17,362
1262 - H114	Tractor Replacement	75,000
1262 - S114	Position Support	75,200
7201 - 0488	Donations	60
7208 - C102	Contributed Funds	8,214
9251 - 0000	Fire base	3,000
9264 -	Wildland Urban Interface	132,450
TOTAL		\$1,355,450

6. Safety

Staff safety meetings are held monthly. In addition to annual safety training (Defensive Driving, CPR, and Hearing tests), the following topics were presented during the year.

Monthly Safety Meeting Topics:

- January - Hearing Tests (Annual)
- March - The Silent Invader and Invasive Species
- April - Fire Safety Tips
- May - HAZMAT
- June - Solar Radiation and Skin Protection
- August - West Nile Virus
- September - Long Term Health Care
- October - Eye Protection
- November - Hearing Tests (Annual)
- December - Cardio Pulmonary Resuscitation (CPR) Training (Annual)

Other safety training included Wildfire Powersaw Course S-212 on March 25-27. Hoffman, Fisher, Smith, Blackwell, and Albeso attended the course.

TO Smith attended the 40-hr Hazwopper Training June 10-14 in addition to Incident Command System ICS 100 & 200 courses in July. Hoffman, Fisher, and Blackwell attended the 8-hour Hazwopper refresher training on June 27th.

On August 6, 2002, refuge staff hosted and participated in Aviation training S-217 Helicopter External Load at the Dillingham Airport on the north shore of O`ahu. With upcoming activities scheduled in the O`ahu Forest, this training was essential. Though a little apprehensive initially working underneath the helicopter, all participants (twelve in all) successfully completed the course.



Helicopter External Load training was essential in order to conduct projects within the O`ahu Forest NWR.

Hoffman, Fisher, Blackwell, and Smith participated in a mock emergency field exercise on July 9-11. Crews were divided into teams and it proved to be largest training to date for resource agencies in Hawai`i and quite an educational experience for all.

7. Technical Assistance

WB Silbernagle worked with Regional biological staff to develop a comprehensive wetlands monitoring and data collection database. This will allow standardization of data among Hawai`i's wetland refuges. This project is ongoing at this time. WB Silbernagle also served on the Wetland Review Team who evaluated wetland management programs on O`ahu, Maui, and Kauai.

Refuge staff participated in the State bi-annual waterbird counts, which occurred on January 16 and August 21.

Throughout the year, RM Stovall provided assistance in organizing the Coastal America Pacific Islands Region Implementation Team.

Refuge Staff provided comments on the Waterbird Recovery Plan. Colleen Henson of Ecological Services met with the staff on August 14th to review the comments.

In a matter of just a few days in late March and early April as many as 20 wedge-tailed shearwaters were killed by dogs from a colony of birds at the Kahuku Public Golf Course. Golf course superintendent Glen Kakuni called refuge staff, wondering what could be done to protect the remainder of the colony. ARM Hoffman contacted the State. They didn't have the funds or personnel resources to address the problem. She then contacted other potential partners such as Ecological Services and the Estate of James Campbell to help protect the colony. Fencing materials equaled about \$1,000 and were paid for Ecological Services from their coastal restoration fund. The Estate granted permission to erect the fence on their property, on which the golf course is situated. On May 8, 2002, refuge staff, Blackwell, Albeso, Fisher, and Hoffman worked with State Department of Forestry and Wildlife staff to construct an enclosure around the colony. After the fence was erected, monitoring by refuge staff was conducted

throughout the nesting season. Bird activity was documented within the fence, which proved the colony was still active, but there was no evidence of active nests or fledged chick. Staff will revisit the site during the next breeding season to document any nesting activity. Unfortunately, this is a reoccurring problem throughout the islands, resulting from feral and domestic dogs and cats.



Staff helps to build fence around a shearwater colony at the Kahuku Golf Course.

8. Other Items

The GSA office space lease at 66-590 Kamehameha Highway in Hale'iwa was scheduled to expire in 2003. A letter requesting that this lease be extended for another term was sent to the GSA representative. The current office space of 1,768

square feet and centrally located in relation to each of the refuges still meets our basic requirements. However, in order to obtain more secured storage, we did submit a request to expand into an adjacent room, which would give us another 300 square feet of space. This will also provide us with additional parking for the government vehicles without additional charge.

The U.S. Navy License No. N6274297RP00107, which authorized the U.S. Fish and Wildlife Service use of storage buildings 1493, 1527, 1528, 1529 at the former Barbers Point Naval Air Station, was revoked since the parcel would no longer be transferred to the Service. All property from the site and buildings had to be removed. Many of the items were left over from Midway Phoenix, the contractors for Midway NWR.

In order to return the large unusable items left over from Midway Phoenix back to Defense Reutilization and Marketing Service (DRMO), a Memorandum of Understanding between FWS Region 1 and DRMO was established. This is a mechanism that will allow any Region 1 office to turn in excess items to a DRMO nationwide. CGS has a copy of the MOU, Interagency Agreement Economy Act, and DD 1144 form (one copy of each would be needed at time of turn-in along with the DD Form 1348 1A form(s) for each item being turned in.

F. HABITAT MANAGEMENT

1. General

Hawai`i is the nation's endangered species capital. The peril that faces native Hawaiian flora and fauna, due to lose of habitat and exotic species, is comparable to no other State. Many of these species are endemic and occur only in Hawai`i. Responsibilities of the O`ahu NWR Complex include the protection, enhancement, and management of three refuges consisting of 11 distinct natural community types ranging from dryland coastal ecosystems to wetlands to upper elevation rainforests. There are at least 30 endangered species consisting of plants, waterbirds, forest birds, and terrestrial mollusks that are dependent on these communities for survival.

The O`ahu NWR Complex consists of three distinct refuges: James Campbell NWR, Pearl Harbor NWR, and O`ahu Forest NWR. The James Campbell refuge, located on the north shore of O`ahu, and Pearl Harbor refuge on the south shore are significant remnants of O`ahu's wetlands. Both refuges were established to provide for Hawai`i's four endangered waterbirds as well as migratory waterfowl and shorebirds. A recent addition to the Pearl Harbor NWR is the Kalaeloa Unit, established to

protect endangered plants and their dryland coastal habitat. The third refuge is the O`ahu Forest NWR. It is the only area within the Koolau Mountain Range formally protected for native species. This refuge protects and enhances high elevation native forest ecosystems with at least 24 endangered species of plants, terrestrial mollusks, and birds.

No other Pacific Island refuge has such a broad and diverse range of protected habitat and management programs for endangered and rare endemic species.

2. Wetlands

a. James Campbell NWR

A Cooperative Agreement between Ducks Unlimited and O`ahu NWR Complex was established in 2001 for \$282,600. The agreement shall serve as a service contract to facilitate cooperation between the two parties to complete five Maintenance Management System (MMS) projects within the Ki`i Unit of James Campbell National Wildlife Refuge. The project will benefit Hawai`i's four endangered waterbird waterbirds as well as migratory shorebirds and waterfowl through management of fresh water impoundments. This agreement provides the interchange of services, personnel, and funds necessary to accomplish the objectives listed below:

Project D/G Dike - \$95K - MMS Project Code 2111-1BCE: This project was altered this year to lower the dike as opposed to building up to restore the approximately 600 feet of a dike between Pond D and Pond G. The windward side of the dike has been severely compromised due to wind and water erosion and we feel we could now lower the dike to increase the pond size while still maintain water level control between the two ponds. The soil removed will be used to restore other dikes in the unit. The project should be completed in 2003.

Project Water Control Structures - \$37K - MMS Project Code 2111-1BCFa: Thirteen water control structures will be revamped to prevent erosion from occurring around the sides and creating a safe and easy means to adjust boards. Two water control structures are located at the Pearl Harbor NWR, Honouliuli Unit. The project should be completed in 2003.

Project Pipe Elbows - \$5K - MMS Project Code 2111-1BCFb: Elbows will be installed on five valves (valves B, Cmi, Cma, Fma, and G) to prevent the back flow and/or back draft of water from the ponds back into the water trunk line. Outlet diameter shall be calculated to optimize system outflow. The project should be completed in 2003.

Project Pond E Pipe - \$35K - MMS Project Code 2111-1BCFc: A new 6-10" pipe approximately 800 feet in length will be installed which will connect the main trunk water line by the Kiosk to Pond E. An elevated side valve leading into Pond D will also be included. The pipe leading into Pond E will traverse below the Punamano Ditch without creating any impediment to the flow of water through the ditch. The project should be completed in 2003.

Project Well Pump - \$110.6K - MMS Project Code 2111-1BCFd (B114 & 1261): This project was altered from installing a submersible, electric pump adequate in size necessary to pump 1 million gallons per day from Ki'i's three artesian wells to drilling a new larger single well from the same source and having the three small wells as a backup. This will greatly increase our management capability to provide water to the various ponds and eliminate our water deficit in the summer months during the nesting season. This in turn will prevent us from sacrificing half to the refuge each summer due to lack of water. The well should be drilled by February 2003.

Mechanical control of undesirable vegetation has basically been accomplished by mowing in the past. This method has not provided the long term results needed to minimize staff time and prolong habitat benefits. This year, the refuge acquired smaller tractors and different implements to assist habitat improvements. One piece of equipment, a Nipol rotary tiller, showed great promise in improving our ability to provide longer term suitable habitat, particularly for Hawaiian stilts. In the upper end of Pond A, the largest single pond within the Ki'i Unit, was completely covered with dense varying aged *Batis maritima*, causing the loss of a third of the pond to stilt nesting and shorebird foraging. As a test, a section of this degraded area was mowed and tilled and an adjacent site was only mowed. Several months later, the tilled area was nearly devoid of *Batis* while the adjacent mowed area had regrowth of up to six inches. Smaller tractors with lower ground pressure allowed for the use of the tiller on wet soils where as previously our equipment was regularly unable to work without getting stuck.

As in recent years, water levels were drawn down in several Ki`i Unit impoundments due to an inadequate water supply to manage all impoundments. In Pond G, succession continued as emergent vegetation began to dominate the pond becoming a center for moorhen activity. Hawaiian coots also found this pond a favorite. The open water area was predominated by the native *Bacopa monnieri*. This species formed a mat so dense that stilt nests were supported on its surface. Efforts to control this species through water level manipulation was not successful.

The Punamano Unit of James Campbell National Wildlife Refuge is a 40-acre wetland that is being taken over by bulrush. This natural spring wetland is increasingly becoming of less and less value to waterbirds (including Hawai`i's endangered species) due to the increasing growth of bullrush. The National Fish and Wildlife Foundation (NFWF) funded a challenge grant to restore this unit. The original method of restoration proposed helicopter services to apply herbicide to bulrush because at the time this project was proposed, there was no other efficient means of controlling the vegetation that has almost covered this natural wetland. With the pending purchase and use of an amphibious excavator through the Wetland Restoration and Protection Partnership (see Section E.8.), we requested that the project funding be approved for the operation of the amphibious excavator. If the amphibious excavator is not available, than the funds will go to contract the labor and accomplish the project by hand early next year. NFWF approved the request and granted an extension to June 2003.

b. Pearl Harbor NWR

The Pearl Harbor National Wildlife Refuge (Refuge) was established in 1972 along the shoreline of Pearl Harbor and is divided into two discrete geographic units (Waiawa Unit and Honouliuli Unit) totaling 61 acres. Both units serve as feeding, foraging, loafing and nesting habitat for the four species of endangered waterbirds and other federally protected migratory birds including shorebirds and waterfowl. The U.S. Department of the Navy owns the land that comprises both units, but units are managed by the U.S. Fish and Wildlife Service (Service) under a Use Agreement. This Use Agreement is in effect indefinitely, but the U.S. Department of the Navy may terminate the Agreement at any time for a national emergency declared by the President or Congress, or in the event that the land ceases to be used for the specified purposes.

Pond 2 at Honouliuli still proves to be very productive for stilt and coot nesting/maintenance as well as migratory waterfowl and shorebird

maintenance in its second year post habitat work. It is scheduled for dewatering with habitat manipulation in 2003.

A hydrolab unit was deployed at the Honouliuli unit Pond 2 on January 30th of this year and operated throughout the year. The unit monitored water temperature, dissolved oxygen content, pH, conductivity, and turbidity. The data is being collected in an effort to learn what changes in water parameters are associated with on-site weather conditions and flora/fauna changes. Data from this site is also being looked at in comparison to Kealia Pond NWR, Maui, where similar monitoring is occurring. Further water monitoring in Pond 2 began in August. Lab analysis was performed to determine nitrogen complex content, photosynthesis as well as other chemical parameters for comparing pond chemical nature between the Kealia Pond and Honouliuli Unit, as well as augmenting data collected from the hydrolab. This data is being collected in cooperation with Tim Mayer, Division of Engineering Water Rights.



Hydrolab installed in Pond 2, Honouliuli Unit.

Waiawa Well - The wetland units of Pearl Harbor National Wildlife Refuge was established as a mitigative consequence of the Honolulu International Reef Runway and managed for Hawai'i's four species of endangered waterbirds by the U.S. Fish and Wildlife Service. In the past, the Waiawa unit has been very productive, especially for the endangered Hawaiian Stilt. It also has provided crucial wetland habitat for migratory waterbirds coming from North American, Alaska, and Asia.

Currently, impoundments are managed using water from a natural spring that is channeled into a creek and then pumped from a cistern located within the creek. The system can be easily compromised from surface contaminants entering the creek or the pipe prior to being pumped into the refuge. High quality freshwater is crucial to endangered waterbird management as well as quantity of water. In the past few years, the surrounding area has experienced changes which made us more and more aware of the need for a secure low salinity water source, since water is the essential element of this habitat. This need became extremely apparent this summer, when the ponds went completely dry due to a lack of water coming from the originating spring source.



Waiawa Unit with no water for wetland management.

The lack of water also creates problems due to the fact that groundwater from the adjacent U.S. Navy landfill migrates into the unit. The landfill is a designated Superfund site, and since 1991 the Navy, together with the Service, has been working to determine the ecological risk to the wildlife, particularly to the four endangered Hawaiian species that inhabit the area. The evaluation of risk is calculated using a dilution factor based on rate of pumping vs. groundwater flow conditions. Without this dilution, the risk from landfill contaminants and influx from Pearl Harbor, also a Superfund site, may be considerably higher.

The original intent of the mitigation for the International Reef Runway was to provide habitat for the endangered waterbird species in perpetuity, and there is a genuine possibility that the Hawaiian Stilt can be either downlisted or

delisted in the near future. However, it cannot happen if productive wetlands such as the Waiawa Unit are forsaken. Therefore, the State of Hawaii Department of Transportation was contacted to help us continue to provide habitat for Hawai'i's endangered waterbirds through cost-sharing the expense of a secure water source to which they have responded favorably. The U.S. Navy was also contacted by letter; their reply dated December 19, 2002, identified that since there is uncertainty whether the dilution factor of the contaminants from the landfill is significant, the Navy cannot commit, at this time, to cost sharing the construction of a new well.

A local water resource consultant was contacted. We learned that a water source with low salinity can likely be provided from a well located within the refuge boundary. An application to the Department of Land and Natural Resources, Commission on Water Resource Management, for well construction and a groundwater use permit was submitted and approved on September 24, 2002. The expense of installing a new well is estimated at \$223,250 and drilling should begin in January of 2003.

Chevron Mitigation Project - Waiawa Unit - The 24.5-acre unit of the Refuge is on the western shore of the Pearl City Peninsula at the upper reach of Middle Loch and is composed of two constructed impoundment ponds. These ponds provide habitat for four species of endangered waterbirds: the Hawaiian Stilt (*Himantopus mexicanus knudseni*), Hawaiian Coot (*Fulica americana alai*), Hawaiian Moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian Duck (*Anas wyvilliana*). Surface water in this unit is pumped into the ponds from a nearby spring-fed, freshwater stream and empties into Pearl Harbor. The western boundary of the unit is vegetated with a dense stand of red mangroves (*Rhizophora mangle*), an exotic species that has invaded the shallow waters along the shoreline.

Red mangroves have had a negative effect in Hawai'i because the trees encroach on coastal shorelines and near-shore waters, displace native fauna and flora, and have altered coastline hydrodynamics and patterns of near-shore sedimentation. These introduced trees displace and alter habitat essential to a number of native estuarine species such as juvenile and adult Hawaiian anchovies (*Enchasiicholina purpurea*). By encroaching into the shallow mudflats near the shoreline, the mangroves displace foraging habitat for various species of waterbirds and shorebirds.

The primary objective of this mitigation project is to remove approximately four acres of red mangroves along the western boundary of the Waiawa Unit of Pearl Harbor shoreline to create a more open intertidal environment and

shallow subtidal mudflat habitat for estuarine species and foraging waterbirds adjacent to the Refuge.

In addition to the mangrove removal, several smaller, associated projects are necessary to achieve the objective of the proposal. These include:

- ▶ construction of a fence to provide security and predator exclusion along the western boundary of the Unit;
- ▶ purchase and deployment of a floating barrier to prevent red mangrove seedlings (propagules) from settling and recolonizing the area; and
- ▶ revegetation of the shoreline with selected native vegetation following the red mangrove removal project.

This project also presents the opportunity for studies to monitor the effect of removal of mangroves, the effects on the benthic community, and the success of revegetation efforts.

Removing red mangrove can be a very labor intensive undertaking, using a chain saw to manually cut each tree for removal. Plans are to use available funds to employ the use of an amphibious long-reach excavator (see Section F. 2.c.) to mechanically remove the mangrove. Because of amphibious pontoons, this machine is able to access areas along Pearl Harbor where conventional equipment cannot. In either method, removal of adult red mangroves will be accomplished by cutting or mulching the tree below the water line to prevent them from re-emerging. The root systems, which will slowly degrade, will not be removed, thereby minimizing disturbance of sediments. Herbicide (Garlon ®) will be applied to the stumps of all trees that have been cut or mulched above the water line to prevent regrowth.

Once cut, the vegetative material will either be chipped on site or hauled off site for mulching prior to disposing the green waste at an approved facility. Additional expenses associated with the removal of mangroves include support equipment and labor contracts, charges to chip and haul the vegetative material, and associated tipping fees for green waste disposal.

After mangrove removal, the shoreline will be revegetated to stabilize the area and prevent soil erosion into the water. Contractual services will be secured to purchase and propagate native plants, fence the area with predator proof material, purchase and secure a boom line to minimize the area from being recolonized by propagules from surrounding areas, and provide periodic maintenance to remove any red mangrove seedlings.

Estimated Costs:

Equipment/Labor: \$50,000

Chipping Fees: \$33,000

Hauling/Tipping Fees: \$4,000

Predator Fence Installation: \$57,000

Native Plant Propagation: \$20,000

Project Support Costs: \$11,000

(Project Subtotal FY03: \$175,000)

Periodic Maintenance: \$5,000/year for five years (FY04-FY08).

Total Project Cost: \$200,000

Meetings with the Natural Resource Damage Assessment Trustees were scheduled for site visits on December 10th with follow up meetings on the 11th and 12th. FWS Roger Helm, Charlie Hebert, and Chuck McKinley participated in the Waiawa Unit site visit hosted by RM Stovall and ARM Hoffman.

Funding for this project is soon to be released.

- c. Wetland Restoration and Protection Partnership - Hawai`i's wetlands are plagued with invasive alien vegetation which grows exceedingly well in our tropical environment, choking out wetlands and rendering them valueless. To more efficiently restore and maintain suitable wetland habitat in varying depths of water, mud, and muck, RM Stovall sought equipment capable of traversing all sorts of terrain. What she found was an amphibious long reach excavator capable of doing just about anything.

A machine of this caliber shared among wetland managers on the island would make a momentous effort in restoring Hawai`i's wetlands and shorelines for four endangered waterbirds, migratory shorebirds and waterfowl, and native fisheries. To realize this, RM Stovall's efforts refocused on creating a partnership with private, non-profit, State, and Federal land management agencies. Informally, the Wetland Restoration and Protection Partnership was formed. Entities interested in the partnership included the U.S. Fish and Wildlife Service, City and County of Honolulu, U.S. Navy, U.S. Attorney's Office (Weed and Seed Program), State of Hawaii Department of Land and Natural Resources, Ducks Unlimited, Kaneohe Marine Corps, Kamehameha Schools Bernice Pauahi Bishop Estate, and U.S. Army Corps of Engineers.

The City and County issue a request for bids in December of 2000. Quality Industries, Inc. was awarded the bid. The excavator and its amphibious pontoons arrived in February of 2001. It was assembled and first tested in the water in December 2001. Both a Honolulu City and County employee and a Fish and Wildlife Service employee (TO Albeso) received training on the machine and on its various attachments from a Quality Industries representative. Although it developed a small oil leak on the last day of training, it amazed a lot of people at its capabilities.



The amphibious excavator may be the answer to help wetland managers restore wetlands all over Hawai`i.

Prior to operating the machine off of City and County of Honolulu (City) property and with an operator other than an City employee, a Memorandum of Understanding needs to be created. A draft MOU was provided to the City in August of 2001; however, they identified that they prefer to use a different format and will provide a draft for our review after their solicitor provides comments.

In support of this Partnership and restoration efforts, several grants were awarded which included \$100K from the Hawaii Biodiversity Joint Venture Program and we were even more excited to receive a \$1M dollar grant through the North America Wetlands Conservation Act (NAWCA). It is the first NAWCA grant awarded for the State of Hawaii. A big *mahalo* goes to

Sharon Reilly with Ducks Unlimited who submitted the application on behalf of the Partnership. Sites visits were conducted by Sam Lawry (AZ Game and Fish) of the NAWCA Council and Carey Smith, Pacific Coast Joint Venture Coordinator, on June 10-11. The site tours were exceptional and well received. Mr. Lawry indicated after the site visit that he would be recommending that the council fund our proposal. He was extremely impressed by everyone's enthusiasm for each of the separate projects and the level of cooperation and commitment by all of the partners. The Partners were notified in August of the award.

U.S. Attorney Steve Alm accepted another position and Mr. Edward Kubo has replaced him as the new U.S. Attorney. A meeting was held with U.S. Attorney Kubo, Project Leader Jerry Leinecke, and RM Stovall on December the 10th to discuss the status of the projects, particularly the Weed and Seed site and use of the amphibious machine. Mr. Kubo will schedule another meeting with the Fish and Wildlife Service, the City, and other key partners early in January of 2003.

3. Forests

O`ahu Forest National Wildlife Refuge is located on the upper slopes of the misty northern Koolau Mountains and protects some of the last remaining intact native forests on O`ahu. At least nine native natural communities have been identified in the area, including lowland mesic forests, rainforest communities, high elevation cloud forest, and freshwater streams.

The rugged O`ahu Forest NWR offers as much beauty as it does value to Hawai`i's endangered forest species.



Moisture gradients and other environmental differences (temperature, slope, aspect, and exposure to wind and sun) within the refuge provide a diversity of ecological types in close proximity to one another. Mesic are found in the lowest areas of the refuge while wet forests occur in the middle and upper elevation. The highest elevations (2,600 ft) are nearly constantly shrouded in clouds and the high rainfall, fog, drip, and poor soil drainage near the summit contribute to plant associations made up of stunted plants covered with moss, ferns, and other epiphytes. Near the summit crest along exposed cliffs are natural communities featuring plants adapted to strong winds and steep cliff faces.

The nine native communities consist of:

Lama/Ohi`a Lowland Mesic Forest - Remnants of this native natural community type are found intermixed with nonnative dominated communities in the lowest elevations of the refuge (or just below the lower boundary). Rainfall varies seasonally and can exceed 64 inches annually. Lama/Ohi`a forest occurs on steep-sided slopes of gulches and in valleys where they have been protected from wildfires. Lama (*Diopyros sandwicensis*) trees are codominate with `ohi`a (*Metrosideros polymorpha*).

Koa/Ohi`a Lowland Mesic Forest - Occurs in the lowest elevations of the refuge between 1,000 to 2,100 feet above sea level. Rainfall ranges from 30 inches to greater than 75 inches annually. The understory features uluhe mat ferns (*Dicranopteris linearis*) that have been invaded with introduced broomsedge (*Andropogon virginicus*) in areas that have been burned by fire.

`Ohi`a Lowland Mesic Forest - This community supports a number of rare plants and provides habitat for endangered O`ahu tree snails, native forest birds, and native insects. There is a distinctive mixture of native trees and shrubs with a relatively closed canopy.

`Ohi`a Lowland Wet Forest - With increasing elevation and moisture, mesic forest communities grade into wet forests dominated by `Ohi`a. This dense rainforest supports a mixture of native trees and rare plants and is widespread in the upper slopes of the leeward Koolau Mountains.

Loulu Hiwa Lowland Wet Forest - This rare native natural community type consists of groves of native loulu hiwa palms (*Pritchardia martii*) that occur on steep windward slopes and gulches at the heads of valleys within the refuge. Reports indicate there are fewer than 10 intact examples of this community type and all are restricted to the Koolau Mountains of O`ahu. Consequently, this natural community is considered globally rare.

Uluhe Lowland Wet Shrubland - This common shrubland is comprised primarily of uluhe (*Dicranopteris linearis*).

Mixed Fern/Shrub Montane Wet Cliff - This natural community is encountered near the cloud-shrouded summit. It is dominated by low-statured plants. Several endangered plants and tree snails have been found on low shrubs in this community type.

ʻOhiʻa Montane Wet Shrubland - This shrub community grows on the cool wet windward cliffs and upper ridge crests of the refuge, generally above the 2,500-foot elevation. Annual rainfall exceeds 100 inches and can approach 200 inches. Vegetation includes stunted ʻohiʻa trees and other dwarf endemic trees and shrubs along with an abundance of epiphytic bryophytes, ferns, and lichens.

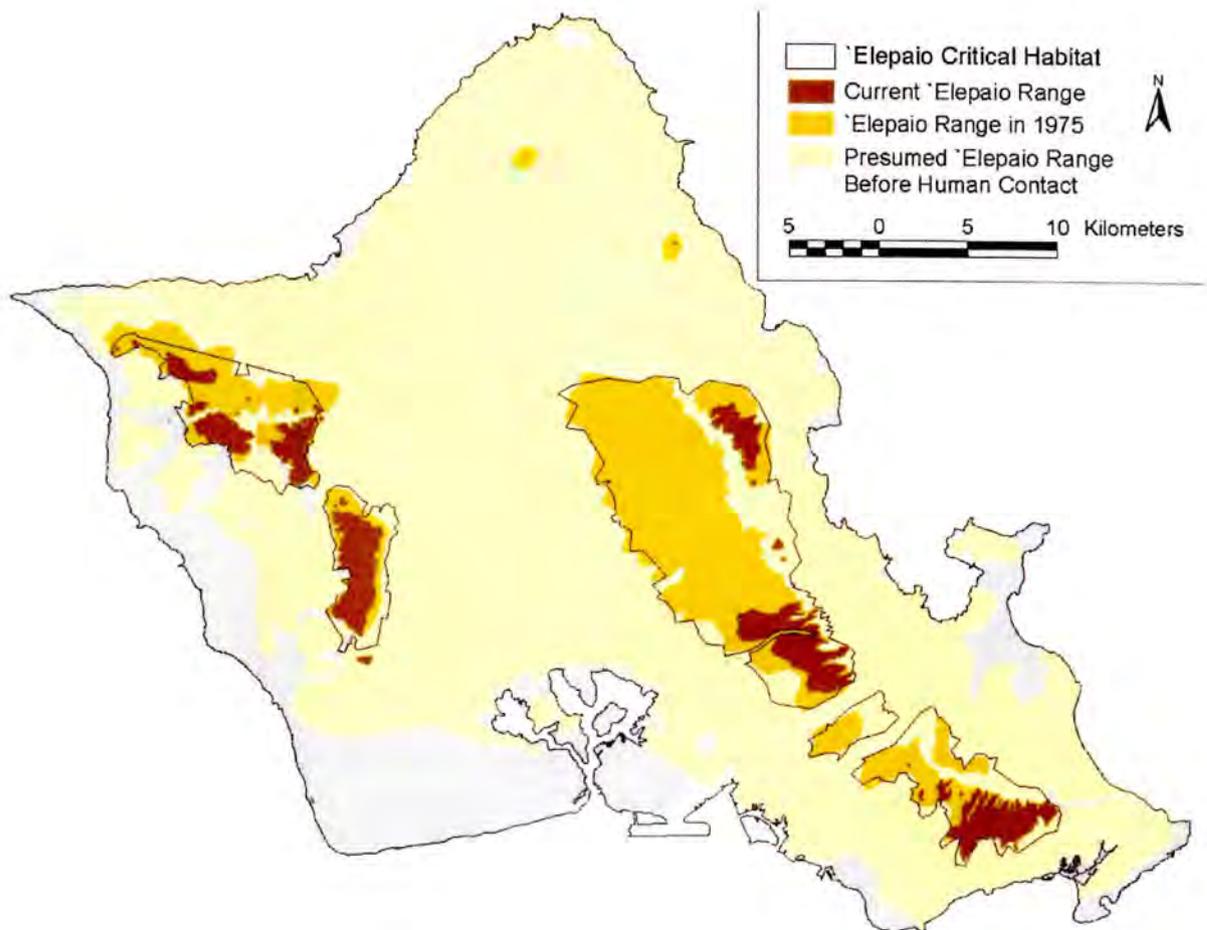
Hawaiian intermittent stream aquatic community - Hawaiian streams in the refuge are classified as intermittent. Even as high as the uppermost elevations, some water is present year round in pools, and during times of moderate rainfall the streams are flowing. Streams support native amphidromous fishes (gobies), snails, shrimp, and other invertebrates including native insects, and a native freshwater sponge.

Oʻahu Forest NWR has at minimum 24 listed species. Since the new refuge has not received any base funding, we were fortunate in finding outside dollars this year to begin the process of collecting basic biological information to provide sound foundations for all future management activities. This information will be essential for implementing a recovery program. Surveys scheduled for early next year will locate, identify, and estimate population density of threatened and endangered species (plants, birds, and terrestrial invertebrates.)

This funding was also key to being able to contract with a local individual, Keahialaka Balaz, who is very familiar with the lands and resources of Oʻahu Forest NWR. Through the support of the Ecological Services' Oʻahu Island Team, we were able to contract with Balaz for full time service for over a year. He will serve as part of the Oʻahu NWR Complex staff and will help to obtain essential biological data of endangered species within the Koolau Mountains, restore endangered species habitats, protect native Hawaiian species from extinction, aid in the coordination of ecosystem restoration efforts between Koolau Mountain Range land managers and watershed partners, provide public outreach, and serve as liaison between the Fish and Wildlife Service and special interest groups such as the Oʻahu Pig Hunters Association.

Forest restoration efforts will include removing alien threats such as rats, pigs, snails, and/or invasive plants from the area, protect the predation threat possibly with predator fences, and provide periodic maintenance. Exclusion or predator fences will vary in size depending on the area of sensitivity and species being protected.

In December of 2001, critical habitat was designated over five areas encompassing 65,879 acres for the O`ahu `elepaio. The `elepaio was once described as the commonest native land bird to be found on the island. It was placed on the endangered species list by the Fish and Wildlife Service on May 18, 2000. The area designated as critical habitat are those areas with the physical and biological features essential to the conservation of the species and that may require special management considerations or protection. Lands within the O`ahu Forest NWR fall within this designation since it is a new refuge and management programs are in their infancy.



Under the Endangered Species Act, 29 percent of the island of O`ahu (111,364 acres) is being proposed as critical habitat for ninety-nine plant species on the island. Much of the acreage is in the Koolau and Waianae Mountain ranges. All of the O`ahu Forest NWR located in the Koolau Mountains would be included. Fifty-two of these plant species are found only on O`ahu. For at least 40 species, fewer than 50 individual plants remain in the wild. The comment period was originally scheduled to close on July 29, 2002, but it has been re-opened twice with the final comment period closing on November 30, 2002.

4. Croplands

Nothing to report.

5. Grasslands

Nothing to report.

6. Other Habitats

The Kalaeloa Unit consists of 37.4 acres of dry land coastal habitat located on the leeward side of the island and is the largest native remnant stand of the endangered `Ewa hinahina (*Aycharanthes splendens* var. *rotundata*) and other native coastal plants. The bulk of the area, however, is dominated by an open-canopy forest of introduced kiawe trees (*Prosopis pallida*) and koa haole (*Leucana leucocephala*). Indian fleabane (*Pluchea indica*), sourbush (*Pluchea symphytifolia*), and grasses form a transition zone between the native plant community and the open-canopy kiawe forest. The substrate in this area is a thin layer of silty soil over coralline limestone.

The Kalaeloa Unit of Pearl Harbor National Wildlife Refuge is located on the dry side of O`ahu and receives less than 20 inches of annual rainfall, creating a severe fire hazard. The high amount of fire fuel in this area proposed fire threats to two nearby residential communities and threats to users of the adjacent airport used for private and commercial flights, as well as to the U.S Coast Guard. The approach to the airport runway is directly over this unit and a wildfire would hinder and/or restrict all landings and takeoffs. The risk of fires are heightened due to locals camping along the coastline and building camp fires adjacent to the unit as well as from fireworks, which are common in this area of Hawai`i. To reduce these risks, we were granted funding through the Wildland Urban Interface (WUI) program to remove the thick vegetation that predominately consists of mesquite trees, brush, buffalo grass, and pluchea. We contracted the services to mechanically remove, chip, and haul away the vegetation, lessening the heavy fuel loads. We also contracted services to

outcrop native vegetation, in order to establish the area with species of minimal fire hazards with a year of maintenance to the newly planted plants. If no outcropping and maintenance were to take place, the invasive heavy fuel species would easily overcome the area again in a short time span. Though the initial expense is high and will have to be funded in phases, this project will produce lasting results and will be more manageable, with minimal fire risk to the adjacent areas.

Restoration activities at the Kalaeloa Unit have been primarily provided by volunteers, Bruce Koebele, PhD., Leeward Community College's Professor Frank Stanton, and his biology class students and a variety of other groups and individuals (see Section E.4.) A total of 87 truckloads/tarps of mostly *Pluchea* spp. were eradicated and removed from the restoration site in 2002. These plants were dumped on the *mauka* border of the Unit. (*Leucaena leucocephala* constituted approximately five of these truckloads/tarps.). A total of eighty-seven 33-gallon bags of alien weeds, principally *Atriplex* spp., *Cenchrus ciliaris*, and *Verbesina encelioides*, were eradicated and removed from the site in 2002; this material was not dumped within the Unit but rather at a nearby green waste dump.



Leeward Community College students have been a tremendous help at the Kalaeloa Unit removing invasive vegetation and outcropping native coastal plants.

Koebele reports that the heavy rains in the Fall through Spring of 2002 were the most likely reason for many native plant seeds sprouting and the subsequent seedlings surviving to the new year. Koebele did not collect data on natural recruitment. However, wild recruits of all the native species present at Kalaeloa have been seen in the cleared areas. The most common are *Achyranthes* seedlings; the least common are *Capparis* seedlings. In 2002, they documented for the first time the appearance of *Ipomoea indica*.

A total of 139 native plants were planted within the Unit in 2002. This is more plants than in all previous years combined (i.e., four years to outplant 123 plants). The increase in outplanting can be attributed to an increase in the number of service trips per year and the refinement of a successful outplanting protocol. As of January 2003, survivorship for plants planted in 2002 was 83% (92 of 111), and for plants planted in 2001 the survivorship is now 58% (30 of 52). From November 1997 to January 2002, the outplant survivorship is calculated to be 56% (69 of 123).

Individual species outplant survivorships for plants outplanted from November 1997 to January 2002 were as follows: *Achyranthes* - 13% (4 of 32); *Capparis* - 59% (19 of 32); *Chamaesyce* - 60% (6 of 10); *Erythrina* - 25% (2 of 8); *Lycium* - 100% (5 of 5); *Myoporum* - 79% (27 of 34). Outplanting death of *Capparis*, *Chamaesyce* and *Erythrina* was usually because the young outplant failed to establish itself. However, the poorest survivorship of *Achyranthes splendens* is not easily explained. Many now dead *Achyranthes* survived the initial outplanting, grew vigorously and then rapidly died. Interestingly, most long-lived *Achyranthes* seem to be naturally occurring recruits to cleared areas (anecdotal observation). The reason(s) for the outplanted *Achyranthes* poor survivorship is unknown. However, Koebele's hypotheses include: (1) outplantings were in an altered soil type not conducive to long-term survival, (2) plantings were too close to the ocean with storm salt spray the mortal agent, (3) the species has a very short lifespan more dependent on plant size than on plant age.

Chamaesyce skottsbergii outplanting trials continued in 2002 with a second (1-24-02) and third (3-16-02) outplanting of ten plants each (first trial occurred on 10-13-01). Each trial was planted in a different location within the restoration area. It has been difficult to positively assess the success of these trials because the species sheds its leaves during periods of drought and, therefore, appears dead. However, Koebele's best assessment as of this date is that six of ten plants (60%) are still alive at the first trial site, zero of ten plants (0%) are still alive at the second trial site, and four of ten plants (40%) are still alive at the third trial site. Hypotheses for the failure of the second site include: (1) the modified soil at the site, (2) the nearness of the ocean, and (3) the excessive wind.

Two new experiments in 2002 were: (1) outplanting using an *o'o* to create a small, deep hole rather than a one foot by one foot hole with a pick, and (2) outplanting *Jacquemontia ovalifolia* and *Sesuvium portulacastrum* plants, grown from cuttings, to speed the native plant coverage of cleared areas. The success of the easier *o'o* planting method (80%) appears roughly equivalent to that of our standard protocol (83%). However, without careful monitoring, volunteers tend to outplant native plants too deeply in the *o'o* hole and have difficulty watering. In other words, while the *o'o* protocol is physically easier, it requires a higher skill level of volunteers. The second experiment was only recently conducted (11-16-02). In this experiment,

minimal holes were dug and only three gallons of water were used during outplanting. To date, Koebele has no definitive results from this experiment.

A total of 12.7 inches of rain fell at the site from December 28, 2001 to November 21, 2002. Most of this rain fell in February, April, May, and October.

For 2003, Koebele's group intends to concentrate clearing efforts on the near-coastal area immediately *makai* of the Unit fence. During the previous five years, no restoration efforts have been conducted in this area; however, Assistant Manager Hoffman, with the help of the YCC, did some clearing of this area during the summer. This area supports one of the few remaining *Heliotropium anomalum* populations on O'ahu. It is anticipated that simply clearing the area of alien plants will return it to a near-native plant community. Therefore, native plantings will continue only within the fenced Unit in 2003. Another focus for 2003 will be increasing the *Chamaesyce skottsbergii* population at trial site 1 via outplanting. Lastly, with the possibility of a city waterline being activated within the Unit through the Wildland Urban Interface project (WUI), it is hoped that outplantings in 2003 and beyond can be dramatically increased.

7. **Grazing**

Nothing to report.

8. **Haying**

Nothing to report.

9. **Fire Management**

Fire Management Plans for James Campbell and the Pearl Harbor refuges were submitted this year, thanks to WB Silbernagle. The James Campbell NWR plan was signed in the Regional Office in October and has been returned. We are anticipating getting the signed plan for Pearl Harbor NWR in the near future. The O'ahu Forest NWR Fire Management Plan is close to completion and will be submitted for signature in the near future. Each plan was written as an operational guide for managing the Refuges' wildland fire program. It defines levels of protection needed to ensure safety and protect facilities and resources. The James Campbell NWR plan was the only plan that included prescribed fire as a management tool. These plans were written to comply with the Service-wide requirement that Refuges with burnable vegetation develop a fire management plan (620 DM 1).

To reduce fire risks to the surrounding community of the Kalaeloa Unit of Pearl Harbor National Wildlife Refuge, funding was awarded through the Wildland Urban Interface (WUI) program to remove the hazardous fuels located within the unit. The high amount of fire fuel in this area proposed fire threats to two nearby residential communities and threats to users of the adjacent airport used for private and commercial flights, as well as to the U.S Coast Guard. The approach to the airport runway is directly over this unit and a wildfire would hinder and/or restrict all landings and takeoffs. For more information please see F.6. Other Habitats.

The following staff members successfully completed the Wildfire Power Saw (S-212) course March 25-27: ARM Hoffman, WS Fisher, TO's Smith, Blackwell, and Albeso. These individuals are now considered "Class A Certified" saw operators and may operate independently on material up to 12 inches in diameter.

All prescribed fires for habitat enhancement were cancelled this year since there was not an approved Fire Management Plan for James Campbell NWR in place. For this reason, most of the refuge staff did not participate in the annual physical activity capacity tests. RM Stovall and WB Silbernagle had completed the work capacity tests at Law Enforcement refresher. They also attended the 8-hr fire refresher course held at the USS Arizona NPS on June 27.

Prescribed Fire Management Officer Roddy Baumann was on site March 28 to help staff set up the Wildfire Hazard Identification and Mitigation System (WHIMS) and Geostationary Operational Environmental Satellite (GOES) system to the FTS fire weather station at Ki'i. The system regularly transmits data via satellite to a mainland US data collection center and is available for use in fire weather observations. This FTS system, with a remote dial-in, has proven to be very reliable and user friendly. Remote dial-in allows us to instantaneously evaluate weather from the office, which is very helpful, particularly on potential burn days. During the same process, the old tower mast was removed and the entire FTS weather system mounted on a more compact "lunar module" system.



The new "lunar module" weather system has really worked out very nice.

10. Pest Control

Due to the remoteness of the Hawaiian Islands, only a relatively few species of plants and animals managed to colonize before humans arrived. From the original several hundred species that arrived by ocean or air, many thousands of species evolved, most of which are unique to Hawai'i. Changes to the landscape began with the arrival of the Polynesians who brought with them plants for cultivation, domesticated animals such as pigs, dogs, and chickens, and incidental rats and insects. Another wave of non-indigenous species were introduced with the arrival of the Europeans in 1778, making the rate of introductions many times over a natural rate. Many of these species, in addition to subsequent introductions (even deliberate, well intentioned introductions) have now turned into pest species and have played a significant role in the extinction of indigenous species and continue to do so. (Also see Section G.15. Animal Control)

a. Wetland Pest Control

The alteration of wetland plant communities due to invasion by nonnative plants greatly reduces the usefulness of wetland areas to native waterbirds. This primary problem we face creates a habitat maintenance program that is very labor intensive and we are further encumbered by a 12-month growing season. Species such as California grass (*Brachiaria mutica*), pickleweed (*Batis maritima*), and Indian fleabane (*Pluchea indica*) out-compete more desirable species and eliminate open water, exposed mudflats, and shallows. Refuge management employs a mixture of control measures for alien invasive plants. These measures include chemical controls, mechanical controls by hand and tractor, water level manipulations, and prescribed fire.



A tractor operator's work is never done in Hawai'i's wetlands.

Mechanical control of undesirable vegetation has basically been accomplished by mowing in the past. This method has not provided the long term results needed to minimize staff time and prolong habitat benefits. This year, the refuge acquired smaller tractors and different implements to assist habitat improvements. One piece of equipment, a Nipol rotary tiller, showed great promise in improving our ability to provided longer term suitable habitat, particularly for Hawaiian stilts. The upper end of Pond A, the largest single pond within the Ki`i Unit, was completely covered with dense varying aged *Batis maritima*, causing the loss of a third of the pond to stilt nesting and shorebird foraging. As a test, a section of this degraded area was mowed and tilled and an adjacent site was only mowed. Several months later, the tilled area was nearly devoid of *Batis* while the adjacent mowed area had regrowth of up to six inches. Smaller tractors with lower ground pressure allowed for the use of the tiller on wet soils where previously our equipment was unable to work without getting stuck regularly.



The lighter weight tractors have enabled us to access places that we would never try to attempt before.

Under the Department of Interior Pesticide Use Proposal, the herbicide Rodeo® is applied for the purpose of controlling undesirable vegetation encroaching into endangered species habitat, creating suitable open water and/or vegetative interspersion, reducing predator concealment cover, and maintaining suitable wetland successional stages for endangered waterbirds and other migratory waterbird species. This is achieved through spraying and burning or spraying and mowing the dead vegetative residue.

Once the herbicide kills the vegetation, prescribed burns are used as a mechanism to maintain interspersed vegetation and return nutrients to the soil. This in turn promotes the invertebrate prey base needed by many of the waterbirds that use the refuge. Prescribed burns are carried out only at the James Campbell NWR (see Section F.9.).

b. Forest Pest Control

Alien plants and animals are the primary threat to native forest species. Invasive alien plants (see below) compete for space, light, water, and nutrients. Non-native birds eat the food and occupy nesting areas needed by native bird species. Mosquitoes serve as vectors for lethal bird diseases such as avian malaria. The invertebrate, two-spotted leaf hopper can devastate native vegetation. Black rats (*Rattus rattus*) and Polynesian rats (*Rattus exulans*) eat the fruit and bark of native plants; prey on bird eggs and nestlings; and are major predators of endangered tree snails. Pigs (see below) forage on native plants and seeds, and create an environment where invasive species flourish. The list continues with nonnative predatory tree snails, ants, . . . we have plenty of pests to control. (Also see Section G.15. Animal Control)

Alien plants of particular concern in O`ahu Forest NWR include strawberry guava (*Psidium Cattleianum*) predominately spread by pigs and birds, Christmas berry (*Schinus terebinthifolius*) a fast growing tree able to form dense thickets, Koster's curse (*Clidemia hirta*), which is rapidly displacing native vegetation by forming a dense understory, and Lantana (*Lantana camara*), an aggressive thicket-forming shrub that produces chemicals that inhibit the growth of other plant species.

Since the O`ahu Forest NWR was established no refuge funding has been available for staff or projects. Pest control measures needed are tremendous and will be key to restoring and/or maintaining a healthy and diverse native ecosystem.



Balaz and Blackwell erect a sign at the Kipapa trail head about a mile outside the O`ahu Forest boundary.

Management programs complete with staff and associated costs must be initiated as soon as possible due to the tremendous effort needed to reduce or eliminate primary threats to the recovery of endangered and/or threatened species and to promote rehabilitation of the native ecosystem.

Contractor Balaz together with staff and/or volunteers will focus on pest control beginning in 2003. In addition, we plan to conduct surveys early in 2003 to help identify critical and/or priority areas.

11. Water Rights

The State of Hawaii Commission on Water Resource Management has authorized well construction for the Waiawa Unit, Pearl Harbor NWR. A Well Construction Permit PHNWR1 Well (Well No. 2359-19) was issued to the O`ahu NWR Complex on September 24, 2002, along with a Ground-Water Use Permit WUP No. 627. Valley Well Drilling has been awarded the contract and the drilling should begin in February of 2003. Tom Nance Water Resource Engineering has served as the consultant.

The Commission has also received, on November 29, 2002, a completed Well Construction/Pump Installation permit application and filing fee for the Ki`i Unit, James Campbell NWR #4 Well (Well No. 4157-13). They expect to process the application by January or February, at which time a contractor is standing by through Ducks Unlimited as part of the Cooperative Agreement.

12. Wilderness and Special Areas

Nothing to report.

13. WPA Easements

Nothing to report.

14. Farmers Home Administration Conservation Easements

Nothing to report.

15. Private Lands

Nothing to report.

G. WILDLIFE

1. Wildlife Diversity

O`ahu - the gathering place of ancient Hawai`i - still harbors scattered outposts of original natural habitats that have existed in isolation for centuries and now serve as the last reservoirs for Hawai`i's unique plants and animals and as winter havens for migratory birds.

The isolation of the Hawaiian Islands led to an evolution of unique plant and animal species found nowhere else in the world. O`ahu, with 75% of the State's population and less than 10% of its land area, faces threats to its native species that are almost overwhelming. To help offset this, the Service has set aside three national wildlife refuges where O`ahu's remaining native birds, plants, and invertebrates have a chance to survive and hopefully prosper. O`ahu's national wildlife refuges scatter across several distinct habitat types: wetland, mesic (moist) forest, coastal, and dryland forest. Each type supports a broad array of wildlife.

We had the pleasure of several new birds this year to add to our list some of which were new birds for the State of Hawaii. New birds for 2002 are as follows:

- ★ **Black-tailed godwit:** First time this species has been documented on the refuge and in the State. Was present from January 2001 - April 2002 on the Ki`i Unit.
- ★ **Bar-tailed godwit:** Rare in Hawai`i. First time sighted on the O`ahu NWR Complex. Present during November 2002 at the Honouliuli Unit, Pearl Harbor NWR.
- ★ **Semipalmated sandpiper:** Rare in the State. First time documented on the O`ahu NWR Complex. Seen on the Ki`i Unit during September and October 2002.
- ★ **Solitary sandpiper:** Rare in the State. First sighting on the O`ahu NWR Complex. Observed at the Ki`i Unit during September and October 2002.

- ★ **Stilt sandpiper:** First documented sighting in the State and on the O`ahu NWR Complex. Observed on the Ki`i Unit during September 2002.

A bird list for the O`ahu NWR Complex can be located in the back pocket of this narrative.

2. Endangered and/or Threatened Species

Hawai`i, unfortunately known as the nation's extinction capital, has the greatest concentration of threatened and endangered species in the United States and the greatest number of extinct species as well. Its unique biota developed due to a 2,500-mile-wide ocean moat that makes it one of the most remote land masses in the world. More than 90 percent of its species are endemic only to Hawai`i. Introduction of new species has played a significant role in the extinction of indigenous species and continues to do so today.

- a. Wetland Species - The James Campbell NWR and Pearl Harbor NWR provides critical habitat for four endangered Hawaiian waterbirds.

Hawaiian Coot ('alae ke'oke'o) - The Hawaiian coot is endemic to the Hawaiian Islands. This species probably originated from a group of migrant North America coots that remained as residents. The taxonomic status has been debated extensively but in 1993 The American Ornithologists' Union recognized the Hawaiian coot as a distinct species. The Hawaiian coot is smaller in body size than the mainland coot; however, its white bulbous frontal shield is distinctly larger. A small percentage of the population has a red bulbous shield at the top of the frontal shield.

Nesting occurs mostly from March through September, although some nesting occurs year-round. Water levels are critical for nest initiation and success. Clutch size ranges from 3 to 10 eggs with an average of 5 eggs.

Coot numbers have consistently increased on Ki`i Unit to 300+ birds due to habitat maintenance work over the last five years. Water is currently one of our limiting factors, preventing us from providing habitat in all ponds at once. About half of the unit is sacrificed due to a shortage of available water.



Hawaiian coot with chick.

Hawaiian Coot Peak Counts by Refuge Unit - 2002				
Hawaiian Coot	James Campbell NWR		Pearl Harbor NWR	
	Ki`i Unit	Punamano Unit	Honouliuli Unit	Waiawa Unit
	189	5	389	2

Hawaiian Moorhen (‘alae ‘ula) - The Hawaiian moorhen is an endemic subspecies of the common moorhen, although there are no evident plumage or measurable differences from the North American moorhen. The moorhen is quite secretive; its preference to forage in dense emergent vegetation makes it difficult to census. Accurate population assessments are impossible. Counts do, however, provide a rough idea of population trends.



Hawaiian moorhen on nest.

Although survey numbers fluctuate greatly due to the secretiveness of the bird, the moorhen population seems to be on the increase. Recent survey counts for the Ki'i Unit shows the moorhen population to be about 50 birds but the truer population is probably double that. Techniques (studies) to better monitor these birds are needed.

Nesting occurs year-round but most of the activity extends from March through August. Nesting is keyed to water levels and vegetation growth and clutch size averages five eggs per nest.

A moorhen was caught in a predator trap resulting in a broken leg. It was taken to Aloha Animal Hospital in Honolulu for rehabilitation where it spent a few weeks in rehab. At that time, it was suitable for release back onto the refuge. The trap itself was moved to another location.



Hawaiian moorhen caught in mongoose trap and later released after rehabilitation.

Hawaiian Moorhen Peak Counts by Refuge Unit - 2002				
Hawaiian Moorhen	James Campbell NWR		Pearl Harbor NWR	
	Ki'i Unit	Punamano Unit	Honouliuli Unit	Waiawa Unit
	44	0	1	0

This year we saw the return of moorhen to Honouliuli's Pond 1 following habitat work in 2000. One, possibly two birds, were seen during the fall of 2002. The bird(s) were seen sporadically throughout the remainder of the year. No moorhen were observed at the Waiawa unit due to dry pond conditions resulting from inadequate water supply. Once the new well is completed, water management should allow germination of vegetation conducive to supporting moorhen as in the past.

Hawaiian Stilt (āe'o) - The Honouliuli Unit of Pearl Harbor NWR continues to be a productive unit for nests and fledglings. Much of the success can be attributed to a largemidge and various insect food supply, predator control, and increased habitat maintenance in 2000.



Hawaiian stilt with newly hatched chick and eggs.

With the restoration of the 5-acre Pond 1, its success also increased. For many years due to the overgrowth of vegetation, Pond 1 has not had a successful coot or stilt nest. Again due to our increased ability to provide

additional maintenance (four maintenance personnel) compared to previous years, we already have seen great results in Pond 1.

Hawaiian Stilt Peak Counts by Refuge Unit - 2002				
Hawaiian Stilt	James Campbell NWR		Pearl Harbor NWR	
	Ki`i Unit	Punamano Unit	Honouliuli Unit	Waiawa Unit
	133	0	99	87

Stilts on the James Campbell NWR, Ki`i Unit have remained fairly constant since the early 90's with peaks of over 100 birds. Peaks normally occur between September and April. Stilts, who seem fairly mobile based on what little information we have, appear to travel in localized intra island movements. A banding program could really benefit biologists by providing a better understanding of the movements, family structure (to help determine site tenacity), and longevity.

Hawaiian Duck (koloa) - Though closely related to the North American mallard, the koloa is a distinct species. It is a small, drab-brown duck of which both sexes are mottled and similar to that of a female mallard. It has an emerald green-to-blue speculum. Koloa breed year round, with a peak breeding period between January and May. Clutch size ranges from 2 to 10 eggs.

Koloa numbers declined noticeably early in the 20th century, caused by predation of rats, mongooses, dogs, cats, habitat reduction and hunting. Due to domestic mallards, there is a high percentage of mallard-koloa hybrids on O`ahu and it is unknown if a pure genetic strand still exists here. Only on Kauai are there no known hybrid koloa.

Hawaiian Duck Peak Counts by Refuge Unit - 2002				
Hawaiian Duck	James Campbell NWR		Pearl Harbor NWR	
	Ki`i Unit	Punamano Unit	Honouliuli Unit	Waiawa Unit
	9	3	1	0

- b. Forest Species - The O`ahu Forest NWR refuge supports at least 17 species of endangered plants, one candidate, and four plant species of concern, at least four species of endangered tree snails (*Achatinella*), a damselfly listed as a candidate, an endangered bird (the O`ahu`elepaio), and the Pueo or short-eared owl which is listed endangered with the State, as well as other rare and native flora and fauna species. Many of the native plants and animals that once thrived in these forests are either extinct or on the brink of extinction, and management intervention is needed to stabilize native ecosystems and prevent more species from becoming extinct.



Endangered *Achatinella decipiens*.

It is critical that basic biological information be collected to provide sound foundations for all management activities. This information is essential to implementing a recovery program. Surveys are needed to locate, identify, and estimate population density of threatened and endangered species (plants, birds, and terrestrial invertebrates.) In turn, this information will identify management priorities which are extremely important due to the magnitude of challenges threatening these endangered species. Management for a healthy and diverse native ecosystem will be a very labor intensive program over very rugged and difficult to access terrain. Refuge start-up costs are needed to provide personnel, equipment, and gear necessary to conduct studies in remote areas inaccessible to vehicles.

Plants - The Recovery Plan for O`ahu Plants (USFWS 1998) covers 66 plant taxa, all of which are listed as endangered and 56 of which are endemic to the island of O`ahu. Of the two mountain ranges on O`ahu (Waianae and Koolau), the Koolou range is younger, was built by volcanic eruptions, and receives much more rainfall than the Waianae Mountains. The vegetation communities of the Koolau Mountains, especially in the upper elevations to which many of the 66 plant taxa are restricted, are primarily lowland mesic and wet forests dominated by o`hia (*Metrosideros polymorpha*) and other trees and ferns. Most of the remaining native vegetation is restricted to steep valley headwalls and summit areas. The windswept ridges are very steep and are characterized by grasses, ferns, and low growing, stunted shrubs.



Viola Oahuensis,
common name
`Olona, is one of the
many endangered
plants within O`ahu
Forest. `Olona exists
on the wet cloudswept
Koolau Mountain
summit.

The Recovery Plan for the Koolau Mountain Plant Cluster (USFWS 1995) is part of the Recovery Plan for O`ahu Plants. This plan covers 11 plant taxa, all of which are listed as endangered with the following numbers of known remaining individuals at the time the plan was written: *Chamaesyce deppeana* (akoko) - fewer than 50; *Cyanea crispa* (no common name (NCN)) - fewer than 33; *Cyanea truncata* (haha) no known populations; *Cyrtandra crenata* (haiwale) no known populations; *Cyrtandra polyantha* (haiwale) - fewer than 5; *Eugenia koolauensis* (nioi) - fewer than 220; *Hesperomannia arborescens* (NCN) - fewer than 100; *Lobelia oahuensis* (NCN) - fewer than 110; *Melicope lydgatei* (alani) - fewer than 5; *Phlegmariurus nutans* (wawaeiole) - fewer than 4; and *Tetraplasandra gymnocarpa* (oheohe) - fewer than 60. Ten of these taxa are currently restricted to the island of O`ahu. *Hesperomannia arborescens* has one population each on the islands of Molokai and Maui. Historically, three of the taxa were known from Molokai (*Eugenia koolauensis* and *Hesperomannia arborescens*), Lanai (*Hesperomannia arborescens*) and Kauai (*Phlegmariurus nutans*).



The large red capsules of the endangered Chamaesyce rockii are unique in the genus and found within Oahu Forest NWR.

This year `akoko (*Chamaesyce skottsbergii* var. *skottsbergii*) seeds and seedlings were collected from the Barbers Point parcel in efforts to preserve the population for its genetic values since the parcel will no longer be transferred to the U.S. Fish and Wildlife Service. Several of these plants were fostered in a green house and planted on the Kalaeloa parcel this year, which about half survived.

Whistler *et al.* had previously surveyed the area in January 1999 and recorded the number of live and dead `akoko individuals observed (Earth Tech 1999). A team of biologists from the U.S. Fish and Wildlife Service, O`ahu National Wildlife Refuge Complex, U.S. Navy, and State of Hawaii over a period of three weeks, May 30, 2001 to June 15, 2001, walked in two-person teams along transect lines spaced 10 meters apart in order to facilitate a 100% survey of the area. All live plants observed were tagged and individual plant information was recorded on the HRPRG Rare Plant Field Data Form. Relevant individual plant information included: Plant number, Height, Basal Diameter, Age Class, Reproductive Status, and Vigor. GPS locations of groupings of `akoko individuals were recorded using a GPS-PLGR unit.

From these surveys, a total of 129 live `akoko individuals were observed at approximately 32 plant locations. Of these, 11 were adults (woody plants > 24 inches tall) and 118 were juveniles (woody plants < 24 inches tall). Flowering was observed on 20 of the 129 `akoko individuals. Immature fruit

was observed on a limited number of individuals. No cuttings or seeds were collected during this time for propagation.

The endangered *Achyranthes splendens* var *rotundata* is a shrub up to about 6 feet tall with silvery leaves with dense light-colored hairs that produce a silvery color. This characteristic gave rise to the common name of `Ewa hinahina. As the plant grows and becomes large, the outer branches bend to the ground with secondary branches growing upward. This makes the plant appear somewhat sprawling. Once common, most of the plant's habitat is now occupied by housing or agriculture, making it now endangered. The Kalaehoa Unit supports the second largest population on O`ahu.

O`ahu `Elepaio - The O`ahu `elepaio, placed on the endangered species list on May 18, 2000, was once common and widespread in forested areas throughout the island at all elevations. The species is thought to occupy less than four percent of its original range. It is a member of the monarch flycatcher family. It probably evolved in the Hawaiian islands from Melanesian ancestors that colonized the Hawaiian islands via Polynesia or Micronesia. Once established, the `elepaio further evolved into three subspecies, each of which is endemic to a different island: Kaua`i, O`ahu, and Hawai`i. Although all three subspecies still exist, the O`ahu `elepaio is in danger of going extinct. O`ahu `elepaio adults have a dark brown crown and back, white underparts with light brown streaks on the upper breast, and white wing bars, rump, and tail-tips. The long tail is often held up at an angle. `Elepaio are nonmigratory, territorial, and often mate for life.



The endangered O`ahu `elepaio has a loud whistled "El-e-pai-o."

In Hawaiian legend, `elepaio helped canoe makers judge the quality of koa logs to make into canoes. If the bird landed on the log and pecked at it, the wood was considered to be of poor quality. If, however, it landed on the log and sang “ono-ka-ia”, the log was considered sound. Because the `elepaio is an insect-eater, its ability to identify insect infested wood made it a valuable resource to early Hawaiians.

The decline has been attributed to lost and degraded habitat from human activities and invasive species; predation by rats; and avian malaria and pox. Before humans arrived in the Hawaiian islands, nearly all of O`ahu was forested. The O`ahu `elepaio probably occupied nearly all of the forested areas. The bird was so common that, according to early naturalists, it was the most abundant bird from sea level to well above the higher elevations and appeared to be holding its own in O`ahu forests even after so many other native birds had disappeared.

By 1960, the bird occupied 30 percent of its original O`ahu habitat. In 1975, its distribution had declined to 14 percent of its original range, and by 1990, the O`ahu `elepaio was restricted to a total area of just 11,600 acres, approximately 4 percent of its original habitat. The O`ahu `elepaio is now known from only six isolated core sub-populations and several smaller sub-populations in the Ko`olau and Wai`anae mountain ranges, with an estimated total of 1,982 birds. The O`ahu `elepaio was listed as an endangered species on April 18, 2000, and designated critical habitat took effect on January 9, 2002.

The Service designated five areas totaling 65,879 acres as critical habitat for the O`ahu `elepaio, an amount sufficient to support a population of approximately 10,100 birds. Critical habitat for the O`ahu `elepaio includes areas that are currently unoccupied because the critical habitat contains lands expected to support breeding populations as well as intervening lands that provide for periodic dispersal, which is a primary biological need, but not for permanent occupation.

O`ahu Tree Snails - The entire genus of *Achatinella* was listed as endangered on August 31, 1981. This genus consists of 41 species of the O`ahu tree snail, endemic to the island of O`ahu. In 1992, 16 species were presumed extinct, 5 species have not been seen in over 15 years, and 18 of the remaining 20 species are on the verge of extinction. Of these 18 species, 11 of these range within the O`ahu Forest, though many have not been seen for many years. They consist of *A. apexfulva*, *A. bulimoides*, *A. byronii*, *A. casta*, *A. decipiens*,

A. dimorpha, *A. elegans*, *A. leucorraphe*, *A. lila*, *A. livida*, *A. papyracea*, and *A. swiftii* (Recovery Plan, O`ahu Tree Snails, April 1993).



The shell color varies on the endangered Achatinella byronii, but typically it has faint green peripheral band and a dark chestnut band bordering the suture.

Shells of the adult O`ahu tree snails average in size from 0.5 inches to just over an inch in length. The shells are brilliantly colored and patterned in shades of orange, yellow, brown, green, gray, black and white, with smooth glossy surfaces. The genus is characterized by a small tooth which protrudes from the central column of the shell. (See Photo 18 Section F.3)

O`ahu tree snails are found primarily in moist or wet forestland at elevations above 1,000 feet. Though primarily nocturnal, they may become active in the daytime during and/or after heavy rains. Native shrubs and trees are the preferred habitat and they usually rest on branches, trunks, or on the underside of leaves. They are relatively sedentary, with some individuals spending their entire life in a single tree.

Achatinella takes an unusually long time to reach sexual maturity and have a low reproductive rate. Though each snail possesses both male and female sexual organs, they cannot fertilize themselves. They breed throughout the year and can bear up to four young each year.

The most serious threats to the survival of O`ahu tree snails are predation by the introduced carnivorous snail, *Euglandian rosea*, predation by rats, and

loss of habitat due to invasive alien vegetation. The carnivorous snail was introduced from Florida in 1955 in an effort to control the giant African snail. The *Euglandian rosea* follows mucous trails of other gastropods and will climb trees and bushes to capture its prey.

Hawaiian legends say the O`ahu tree snails sang. It was later realized that it was crickets creating the song, but traditions are still carried on today. Collectors gathered the brightly colored snails and their beauty led to an appreciation of the tree snail that helped inspire a more general awareness. Collecting and commercial exploitation helped to reduce *Achatinella* populations. In the mid to late 1800's "land shell fever" hit the island and hundreds of thousands of snails were collected for their shells. Many shell leis were made and by 1914 several species had declined drastically and were considered rare. Though shell collecting subsided around 1940, most species were severely decimated.

3. Waterfowl

Twenty-four species of ducks and geese have been recorded as visitors to the wetland refuges on O`ahu. The most common migrants include the Northern pintail, Northern shoveler, lesser scaup, green-winged teal, American wigeon, and the mallard. Mallards, however, are often difficult to distinguish from resident mallards. Wintering migratory waterfowl use the wetland refuges from September through May, and these units are managed to provide critical habitat for the State's population.

Other migratory waterfowl species documented include greater white-fronted goose, snow goose, brant, Canada goose, garganey, blue-winged teal, cinnamon teal, gadwall, Eurasian wigeon, canvasback, redhead, ring-necked duck, tufted duck, greater scaup, bufflehead and common merganser.

<u>Primary Waterfowl Species</u>	<u>Location</u>	<u>Peak Count</u>	<u>Date</u>
Northern Shoveler	JMC, Ki`i	108	11/19/02
Northern Pintail	PHB, Honouliuli	98	02/19/02
Mallard	JMC, Ki`i	54	09/10/02
Eurasian Wigeon	JMC, Punamano	21	01/16/02
Lesser Scaup	JMC, Punamano	16	12/03/02

Fulvous whistling ducks first appeared in Hawai`i in 1982 on O`ahu, and became established on the north shore in the vicinity of the refuge. It is suspected the birds were illegally introduced to the area but it may have been from natural colonization.

The first record of breeding by this species in Hawai`i was in 1984 at the Ki`i Unit. Nests of this species have only been found on the Ki`i Unit. A lone whistling duck has been observed for several years but it is now assumed to be a goner. It was last documented on December 13, 2001.

4. **Marsh and Waterbirds**

Black-crown night herons, or `Auku`u, are common on the wetlands and are indigenous to Hawai`i. The Hawaiian form has not differentiated greatly from its North American counterpart. Though the heron normally feeds on crustaceans, fish, shrimp, and frogs, it has been documented on occasion to take young waterbirds. It is not known to what extent they are influencing the populations of endangered waterbirds. Aquaculture farmers adjacent to the refuge consider the `Auku`u a threat to their shrimp and prawns, and it is likely the `Auku`u population will increase on the refuge now that the aquaculture farms are operational again since closing in 1995.



*Black-crowned Night-heron.
Photo: Volunteer Tom Dove*

The peak population of Black-crown night herons for James Campbell NWR, Pearl Harbor NWR, Honouliuli Unit, and Pearl Harbor NWR, Waiawa Unit, during 2002 were 115, 3, and 8 respectively.

Cattle egrets have established a roost next to the refuge with counts of over 2000 birds. The cattle egret was introduced to Hawai'i in 1959 in an effort to control arthropod pests in cattle and other livestock. Cattle egrets are known to feed on waterbird chicks, though to what extent it is difficult to determine, but in numbers large enough to warrant control measures. See the section on Pest Control for more information.

The peak counts of cattle egrets actually landing within James Campbell NWR, Pearl Harbor NWR, Honouliuli Unit, and Pearl Harbor NWR, Waiawa Unit during 2002 were 39, 6, and 80 respectively. These counts only include those observed within the refuge boundary and do not include adjacent rookeries. However, as many as 761 egrets were counted March 5 in association with the rookery adjacent to Ki'i.



Cattle Egret.

Photo: Volunteer Tom Dove

5. Shorebirds, Gulls, Terns and Allied Species

The wetland refuges provide some of the best shorebird habitat on O'ahu, and numerous species can be seen during the fall, winter, and spring months. These sites serve as the sole destination for many different species. Some migrants come and go like clockwork while the arrival of others can be a complete surprise. In Hawai'i, one never knows what might show up after a very long flight over the Pacific Ocean. Habitat and water level manipulations greatly benefit these migrants and are equally beneficial for the endangered waterbirds.

Anticipated seasonal guests found on the refuge include the Pacific golden plover or Kolea that migrates from Alaska each year. The plover makes Hawai'i its home for several months until such time as it migrates back to Alaska in early May. Ruddy turnstones and sanderlings are both common winter visitors, arriving in August and leaving for the arctic breeding grounds in April and May. Bristle-thighed curlews thrill bird watchers on our guided tours conducted on the James Campbell NWR, especially those who have tramped many miles in Alaska, looking to add this bird to their life list unsuccessfully. Long-billed dowitchers, usually in small groups, can be easily identified by their feeding habits: probing for worms, grubs, and other invertebrates. These birds journey between O'ahu's wetland refuges and the Arctic tundra of eastern Siberia and western North America. When not nesting in Alaska,

wandering tattlers are generally seen along rocky shorelines. However, the mudflats of the wetland refuges serve as a perfect place to feed and rest in preparation for their long trip back north.

<u>Primary Shorebird Species</u>	<u>Location</u>	<u>Peak Count</u>	<u>Date</u>
Pacific Golden-plover	PHB, Waiawa	299	09/27/02
Ruddy Turnstone	JMC, Ki`i	197	09/24/02
Sanderling	PHB, Waiawa	57	12/03/02
Bristle-thighed Curlew	JMC, Ki`i	16	02/27/02
Long-billed Dowitcher	PHB, Honouliuli	9	12/02/02
Wanderling Tattler	JMC, Ki`i	6	09/24/02

Though not as common as other winter shorebird, visitors also include dunlins, pectoral sandpipers, lesser yellowlegs, sharp-tailed sandpipers, and the occasional gull or tern which have included Glaucous-winged gulls, Bonaparte's gulls, and Caspian terns. For a complete listing of birds please see the bird list located in the back cover of this narrative.



Bristle-thighed Curlew. Photo: Volunteer Tom Dove

6. Raptors

Hawaiian short-eared owls, or pueo, are frequently observed hunting over the wetland refuges and occasionally perched, which allows for a nice long look through binoculars. They can also be found within the O`ahu Forest NWR. The pueo is an endemic race and occurs on all main Hawaiian islands. The State has listed the pueo as endangered on O`ahu.



The Pueo was worshiped as a god and revered as a guardian spirit by the ancient Hawaiians.

The barn owl, common on O`ahu, was introduced from North America in 1958 to 1966 for rodent control in sugar cane and to decrease the impacts of rodents on cane production.

Ospreys are rare but regular winter visitors that can sometimes be observed hunting over the wetland refuges. There were, however, no documented sightings this year.

The island of O`ahu does not have the endangered `io or Hawaiian Hawk. It is located on the Big Island.

7. Other Migratory Birds

Great frigatebirds are occasionally seen soaring effortlessly over the wetland refuges and at times taking a Tilapia or two from the ponds. In addition to the frigatebird, other species of seabirds occasionally seen overhead or in the vicinity include red-footed boobies, black noddies, brown noddies, Laysan albatross, red-tailed tropicbird, and the white-tailed tropicbird.

8. Game Mammals

Ring-necked pheasants reside primarily on the James Campbell NWR but can also be seen or heard at Pearl Harbor NWR. They use the tree and shrub areas for nesting and brood rearing. These birds after being introduced in 1865 are now common on all main Hawaiian islands.

Zebra and spotted doves are common on all three refuges and to a lesser extent the rock dove. The zebra and spotted dove were both introduced from Asia in 1922 and in the mid 1800's respectively. The rock dove or domestic pigeon was first introduced in 1796 and is more common in urban areas.

Erckel's francolin resides in the O`ahu Forest NWR although is not seen or heard of in great numbers. They usually are in habitats above 1,000-foot elevation, but at times are located at sea level. These birds were first introduced to Hawai`i in 1957 from Africa.

9. Marine Mammals

Endangered Hawaiian monk seals (and threatened green sea turtles) are known to occur in waters offshore of Kahuku and have basked on the shore line next to the refuge. These coastal dunes are within our proposed boundary of the refuge and if purchased, protection and enhancement of the beach could further entice seals and turtles to the area. The only documented nesting beach of the island of O`ahu is just to the north of this area.

10. Other Resident Wildlife

Although there is no comprehensive source of information on the current distribution and abundance of native forest birds on O`ahu, past field studies along with some recent information and "quick and dirty" field surveys do provide some information on the occurrence of native forest birds in the O`ahu Forest NWR.

The refuge supports at least four species of native Hawaiian forest birds including the endangered O`ahu `elepaio (*Chasiempis sandwichensis ibidis*), the previously mentioned Hawaiian owl or commonly known as pueo, and two honeycreepers, the O`ahu `Amakihi (*Hemignathus chloris*) and O`ahu `apapane (*Himatione sanguinea sanguinea*).



The `apapane is an active, quick moving bird that forages in the forest canopy for nectar and insects. Photo: Volunteer Tom Dove

The main causes for the decline of O`ahu's native forest birds include avian diseases (malaria and pox) that are transmitted by mosquitos, habitat loss (conversion of native forest for urban development or replacement of native forest communities by nonnative plants), competition with nonnative birds, predation by introduced animals (such as rats and mongooses), and cumulative damage to and loss of the principle food resources used by these species (e.g., grazing by feral pigs, effects of slugs, or loss of specialized food plant pollinators). Low population numbers also likely contribute to declines.

11. Fishery Resources

Streams in the O`ahu Forest have not been intensively or systematically surveyed for native stream fishes. Native aquatic species documented from streams within the Refuge include the indigenous goby or `o`opu nakea (*Awaous guamensis*), the `o`opu nopili (*Aocyopterus Stimpson*), and `o`opu alamo`o (*Lentipes concolor*).

Native invertebrates are opae kala`ole a mountain opae (*Atyoida bisulcata*), hihiwai (*Neritina granosa*), and *Lymnaeid* snails (*Lymnaeidae*), along with a fresh water sponge (*Heteromyenia baileyi*).

Like many streams in Hawai`i, streams on O`ahu are realizing an increasing amount of non native aquatic life. These would include guppies (*Poecilia reticulata*), mollies (*Poecila sp.*), Dojo (*Misgurnus anguilli*) an oriental weather fish, and, unfortunately, a bristlenose catfish (*Ancistrus C.F. temmincki*), which resembles the *pleicostomus*

and is advancing upstream. These fish are aggressive and have spikes. They are competing with native species for space and food and could out-compete native fish if their numbers are not controlled.

12. Wildlife Propagation and Stocking

Nothing to report.

13. Surplus Animal Disposal

Nothing to report.

14. Scientific Collections

Nothing to report.

15. Animal Control

The introduction of mammalian predators has had a severely negative impact on all populations of waterbirds. The small Indian mongoose (*Herpestes auropunctatus*) was first introduced on the island of Hawai`i in 1883 by the Hilo Planters Association as a means of controlling rats in sugarcane fields. They were subsequently introduced to O`ahu, Maui, and Molokai, and have since become a serious threat to waterbirds, taking eggs, young birds, and nesting adults.

This animal spread rapidly and now occurs from sea level to approximately 10,000 feet, but is most numerous below 2,000 feet. It is primarily diurnal, and since rats are primarily nocturnal, the mongoose was ineffective in controlling rat populations. Female mongooses generally breed at one year old and produce two litters (averaging two pups per litter) annually. The breeding season in Hawai`i is from February into September and wetlands provide some of the most productive habitat for these animals.

Cats (*Felis catus*) became established in Hawai`i shortly after European contact and were likely “ship cats” to catch rats and mice on the sailing vessels. Feral cats are common around Hawaiian wetlands, particularly those that are in close proximity to housing areas. These cats are common predators on waterbirds. This is especially noticeable at Pearl Harbor NWR.

Dogs were originally introduced to Hawai'i by the early Polynesians. The general consensus is that there was one distinct breed (the "poi dog") but as European breeds were introduced, crossbreeding resulted in loss of the Hawaiian breed identity. Dog activity is sporadic but common and dogs have the potential to cause extensive damage in breeding areas, in a very short time span preying on waterbird nests, young, and adults.

One of the avian predators is the cattle egret, who specifically preys upon nestlings. Populations close to the refuge have reached into the thousands. Control measures are taken to reduce local populations on or adjacent to the refuge.

Assistance from the U.S. Department of Agriculture Animal and Plant Health Inspection Service, Wildlife Services, is contracted to conduct operational predator control within the James Campbell and Pearl Harbor refuges. They are to reduce or eliminate predation caused by mongooses and other predatory animals such as rats, cattle egrets, and feral dogs and cats in order to protect and enhance the survival of the four species of endangered Hawaiian waterbird populations. Live traps are the primary method of control and are checked every 48 hours. When controlling cattle egrets, only steel shot is used and all carcasses are removed for proper disposal. The contract cost for FY 2002 was \$35,806.

Calendar Year 2002

Species Removed	James Campbell NWR	Pearl Harbor NWR		Total
	Ki'i Unit	Honouliuli Unit	Waiawa Unit	
Mongoose	214	73	126	413
Cattle Egret	439	0	458	897
Feral Dog	2	0	0	2
Feral Cat	13	18	6	37

Feral pigs (*Sus scrofa*) have been known to exist in the Koolau Mountains for many years and are responsible for much of the disturbance and wet forest modification. While foraging, feral pigs root and trample the forest floor, which encourages the establishment of alien plants in newly disturbed soil. Pigs also are a primary cause of spreading alien plant seeds through their feces and on their bodies, accelerating the spread of nonnative plants through the forest. Particularly bad within the refuge is the spread of strawberry guava (*Psidium Cattleianum*). New plants quickly develop

into dense stands, blocking out most other plants and displacing natural vegetation. Pigs also feed on the starchy interiors of the extremely slow growing native tree fern and other succulent-stemmed plants.

For the endangered forest bird, the O`ahu `elepaio, the two main causes of low survival and low reproduction on O`ahu are nest predation by alien black rats (*Rattus rattus*) and alien diseases carried by mosquitos. Nest predation by black rats causes many nests to fail, and rats also probably take adult female `elepaio on the nest at night. Control measures that will be considered include snap traps and diphacinone (an anticoagulant rodenticide) bait stations which, in other locations, have resulted in an 85 percent increase in nest success and a 127 percent increase in fledglings per pair.

On January 30, 2002, Roger MacGibbon of Xcluder Pest Proof Fencing Company, New Zealand, in cooperation with The Nature Conservancy and US FWS biologist Jeff Burgett, addressed the issue of fencing to exclude pest mammal species. At the Kona Hema Reserve in South Kona on the big island of Hawai`i, a fence was installed to test the feasibility of excluding small mammalian predators and feral animals from natural areas in Hawai`i using specially-designed fencing.



The mongoose did not escape through the “predator free fence” during the trail, making the fence worth considering.

Mongoose, feral cats, rats, and mice were placed within the fenced area and observed and timed to document their response to the fencing design. No mammal escaped the

fenced area during the demonstration. The objectives of the demonstration included: 1) to determine if this type of fencing will function on the young lava substrates common in natural areas on the big island of Hawai`i, 2) to minimize costs of the fence design by adapting locally-available materials, 3) to expose a broad array of natural resource managers and planners to a technology that may be key for recovery of forest birds, invertebrates, and plants, and 4) to test and demonstrate the longevity of a selection of wire products in Hawaiian weather conditions. If this actually could keep out predators from wetlands on a multi-year basis, it might be worth the expense since we spend close to \$40,000 annually for predator control. It is worth considering.

16. Marking and Banding

Nothing to report.

17. Disease Prevention and Control

Nothing to report.

H. PUBLIC USE

1. General

Currently, little to no U.S. Fish and Wildlife Service visitor opportunities exist on the island of O`ahu, the most populated and visited of all the Hawaiian Islands. There is a considerable demand from local school groups, commercial tour operators, and the general public for access into the refuge to view wildlife. None of the refuges are "open" to the general public; however, through guided tours, environmental education, special events, and special use permits thousands of people get to visit these special places. During FY02, there were 1,881 visitors recorded at James Campbell NWR, and 6,302 visitors at Pearl Harbor NWR (primarily Hawaii Nature Center participants). O`ahu Forest is closed to the public at this time.

The Service plans to implement a visitor use program on the O`ahu Forest NWR once sufficient baseline inventories are completed to ensure the program can be compatible with the purpose of the refuge. Trails will be restored to allow wildlife viewing, with environmental education being a focus. These opportunities will enable the public to see, learn about, and enjoy the natural resources of the refuge and will increase the public's knowledge and appreciation of Hawai`i's native ecosystem as well as build support for Service conservation programs. By agreement

of purchase and access, the Service is limited to no more than 100 visitors per month and on a guided basis.

2. Outdoor classroom - Students

Since 1993, a special use permit has been issued to Hawaii Nature Center, a non-profit organization to conduct an educational wetland program for third grade students at the Honouliuli Unit, Pearl Harbor NWR. During the Hawaiian stilt non-nesting season, approximately 6,000 students participate annually in the program. They turn away about 1,000 students each year due to the popularity of the program.

A Special Use Permit was authorized for several educational organizations and school groups. The Moanalua Gardens Foundation, a recipient of one of these permits, conducts regular wetland education programs on the Ki'i Unit of James Campbell and has since 1985. About 20 elementary school groups are brought out over the course of the season. This year over 700 students participated in their wetland program.

Frank Stanton, professor at Leeward Community College (LCC), brings his biology class to the Kalaeloa unit of Pearl Harbor NWR to participate in a restoration program. LLC students gain an appreciation of the plight of Hawai'i's endangered plants and are able to contribute to the conservation efforts by removing alien species and planting native seedlings in the cleared areas of the Refuge.



A Leeward Community College biology student is helping out at Kalaeloa. She prepares to outcrop native and endangered plants as part of her class field work.

The efforts of the students have been very valuable to restoration of Kalaeloa.

3. **Outdoor Classrooms - Teachers**

Nothing to report.

4. **Interpretive Foot Trails**

This is the fifth year that the guided public use program has been conducted on James Campbell NWR. There were 1,881 visitors who utilized the foot tour route on the Ki`i Unit. Approximately half were guided tour participants and the other half primarily Special Use Permit environmental education classrooms. This activity is authorized during the stilt non-nesting season. The scheduled guided tours at Ki`i have been very well received and really enjoyed by all participants. Generally we offer a guided tour every Thursday and Saturday from August 1 through February 15. However, due to a late stilt nesting season, tours this year didn't start until October 11. Due to several late seasons since tour inception, we will re-evaluate the start date for the future. The majority of the tours were led by refuge volunteers.

5. **Interpretive Tour Routes**

Nothing to report.

6. **Interpretive Exhibits/Demonstrations**

To increase public awareness, environmental education, and to offer compatible visitor activities, additional lands are needed at James Campbell NWR that would enable the Service to provide a public use/interpretive facilities. The program could provide year-round wildlife viewing opportunities for over a million visitors annually as well as an outdoor education center for students. Activities would focus on the importance of wetlands, their cultural significance, the plight of native plants and birds, and the Service's efforts to preserve essential wetland habitat and save these species from extinction.

A memorial overlook is planned for the Honouliuli Unit of Pearl Harbor NWR. This idea stemmed from a desire to re-tell a little history of the refuge in addition to enabling residents and visitors of Hawai`i an opportunity to view and learn about refuge wetlands. The history begins with the City of Honolulu needing a new airport runway. Most people are not aware that the Pearl Harbor National Wildlife Refuge was created as "mitigation" for the construction of the Honolulu International Airport Reef Runway. Initial efforts to create this refuge started with Betty Nagamine, a teacher and a volunteer with the Hawaii Audubon Society. She lobbied relentlessly to Herman Bliss, the Hawai`i Regional Director of the Federal Aviation

Administration, for mitigation due to impacts from the fill associated with the creation of the reef runway. This started a series of discussions with various agencies. Though a lot of cooperation, the Federal Aviation Administration, the State of Hawaii, the U.S. Navy, and the Fish and Wildlife Service made the refuge a reality. The Pearl Harbor National Wildlife Refuge, composed of two units, was established in 1972 under a Use Agreement between the Navy and the Fish and Wildlife Service.

Betty's noble efforts not only helped to create the Pearl Harbor Refuge, they consequently created a special bond between her and Mr. Bliss. They were married soon thereafter. Unfortunately, there is a sad ending to their happy story. Betty Nagamine Bliss was killed in a tragic car accident on the mainland recently, so this refuge overlook and interpretive site will be dedicated to her memory and show how one person can make a difference.

The project consists of constructing a handicap accessible platform to overlook Pearl Harbor and the Honouliuli Unit of Pearl Harbor National Wildlife Refuge. Panels facing the refuge will serve as observation blinds as well as interpret the importance of wetlands in Hawai'i, the management of endangered species, the area's cultural significance, and how through cooperative efforts this special place was created to benefit local residents and visitors of Hawai'i.

The U.S. Fish and Wildlife Service (USFWS) has committed over \$95,000 in services and materials to the development of this overlook estimated to cost approximately \$350,000. A Cooperative Agreement will enable the transfer of \$45,000 from the Service to the Hawai'i Department of Transportation (HDOT). HDOT will use the \$45,000 along with a \$35,497 contract by the USFWS with Promotional Products, Inc., for the construction design of the overlook and design of its interpretive panels, a \$4,946 contract by the USFWS with R.M. Towill Corporation for the site and topographic survey, and \$10,000 in materials purchased for the overlook, in order to secure \$330,000 in Transportation Enhancement funds from Federal Highways-Federal Aid program. The total funds provided by the USFWS in cash, services, and materials is \$95,443. After receiving the \$45,000 in cash from the USFWS and securing Transportation Enhancement funding, HDOT will include construction of the overlook at the Honouliuli Unit of Pearl Harbor NWR as part of its Leeward Bikeway project, which is expected to begin in 2004.

7. Other Interpretive Programs

Staff celebrated National Wildlife Refuge Week by hosting volunteer work day, with Leeward Community College students assisting us with plant native and endangered coastal plants at the Kalaloa Unit of Pearl Harbor NWR.

Earth Day was celebrated on April 20th at the Kalaeloa Unit of Pearl Harbor NWR. Biologist Silbernagle met a group of volunteer students from the Leeward Community College to weed out invasive vegetation and outplant native plants, including endangered Hawaiian species.

Held at the Wailua Courthouse as part of an environmental lecture series, on July 31, researcher George Balazs, National Marine Fisheries Service, presented “Swimming along with sea turtles in the Hawaiian Islands” to the general public as part of a lecture series sponsored by the O`ahu NWRC. Mr. Balazs is the green sea turtle expert in the Pacific Ocean Region.

Also as part of the series, on September 28, Dr. Mary Donohue, NOAA Fisheries, presented “Marine Debris around the Hawaiian Islands” to the general public as part of a lecture series sponsored by the O`ahu NWRC. Dr. Donohue is the marine debris coordinator for NOAA’s marine debris program in the northwest and main Hawaiian Islands.

The first (to our knowledge) commercial Special Use Permit for conducting guided tours on James Campbell NWR was issued this year. It was issued to Naturalist Journeys out of Arizona for October 18. They were charged the standard commercial fee of \$150 for a guiding permit and were authorized up to 15 clients. No client use days were charged.

8. Hunting

Public hunting is not authorized on any of O`ahu’s three refuges. As identified in the Interim Compatibility Determination for O`ahu Forest NWR, a managed hunt, using local hunters for the purpose of controlling feral pig populations, could be a very valuable tool for managing the O`ahu Forest NWR.

9. Fishing

Fishing is not authorized on any of the three refuges. However, fishing is authorized along the state owned shoreline and is particularly popular adjacent to the Kalaeloa Unit of Pearl Harbor NWR.



Fishing of the coast of Kalaeloa has been a choice spot for the few that make the long walk out.

10. Trapping

Trapping only occurs in conjunction with pest control (see Section F. 10).

11. Wildlife Observation

The Service proposed allowing visitors to hike into O`ahu Forest NWR for the purpose of wildlife observation. An Interim Compatibility Determination for Wildlife Observation, Photography, and Environmental Education and Interpretation was signed this year. Once provisions for the program are in place to ensure compatibility with the purposes of the refuge, the refuge would be opened for small groups of visitors for day hikes on designated trails. Based on the purchase agreement, there must be a staff person per 15 participants, no unguided parties will be allowed to cross private lands in order to access the refuge, and total number of visitors per month will not exceed 100 visitors. Participants must hike approximately one mile to reach the refuge boundary.

An overlook is planned for the Honouliuli Unit of Pearl Harbor NWR. Once completed, this will be the first time the general public is allowed on the refuge. For more information please refer to 7. Other Interpretive Programs of this section.

12. Other Wildlife Oriented Recreation

Nothing to report.

13. Camping

Nothing to report.

14. Picnicking

Nothing to report.

15. Off-Road Vehicling

Nothing to report.

16. Other Non-Wildlife Oriented Recreation

Nothing to report.

17. Law Enforcement

WB Silbernagle attended and successfully completed the R1 Refuge Officer Inservice January 24-28 at Marana, Arizona. RM Stovall attended and successfully completed the R1 Refuge Officer Inservice refresher training February 21-25 at Marana, Arizona. Both collateral duty officers requalified with their Service firearms on August 8th at Haleakala National Park on Maui.

Officers Silbernagle and Stovall attended a training seminar sponsored by the U.S. Attorney's Office for the District of Hawaii and the Environmental Crimes Task Force on September 5, 2002. The seminar covered the major federal criminal statutes which protect wildlife, including the Endangered Species Act, the Migratory Bird Treaty Act, the Lacey Act, and custom laws. John T. Webb, Assistant Chief of the Wildlife and Marine Resources Section, U.S. Department of Justice, Washington, D.C., conducted the seminar.

Assistance was giving to other Hawai'i refuges, particularly at Midway NWR, throughout the year.

On November 14, the new Special Agent Keith Swindle for Hawai'i was shown parts of the O`ahu Forest NWR by contractor Keahialaka Balaz, and where dirt bikes are entering the refuge along Kipapa Trail, damaging the trail and native plant species along the trail. ARM Hoffman erected a Boundary sign along with an Area Closed sign in the center of the trail; the sign has deterred some trespassers. Officers Silbernagle and Stovall patrolled the area on occasion.

So far all the alarms at the Hale`iwa office and Ki`i baseyard have been caused by something other than a thief. No breaks-ins have occurred since the alarm system was installed at Ki`i. However, at a storage unit at the Honouliuli Unit of Pearl Harbor NWR, someone cut the hinge of the container but evidently we didn't have what they were looking for since nothing that we can remember was taken. Also of common occurrence was getting our lock cut off at the Honouliuli gate entrance along the railroad right-of-way. We were having to replace locks several times a month. This forced us to "beef-up" our locking device to something that would prevent bolt cutters from reaching. So far our new lock box has been effective. Since installing it, we have not had to replace any locks on this gate. This design allows up to six locks on the system which will permit the various approved entities access such as the U.S. Navy, Honolulu City and County, Chevron Oil Company, and FWS.



Break-in at Honouliuli Unit.



Newly installed lock box at Honouliuli after replacing countless lock over a few month period.



The lock box allows for multiple locks, and has, so far, worked very well as long as you are limber enough to crawl under.

Security cameras at the Hale`iwa office caught an individual on tape who was tampering with a government vehicle and suspected of siphoning gasoline. It is currently under investigation.

On April 2, the refuge suffered a break-in at the Barbers Point bunkers leased from the Navy. Although investigated by Navy Regional Security, no items were found but were suspected to have been transported to the Big Island for sale. Several items taken and hauled off including a commercial grade chipper valued at \$10,000 and a new John Deere Tiller valued at over \$3,000. Others items included a portable generator, trash pump, small chipper, trimmers, chain saws, and miscellaneous hand tools and equipment. Staff was in the process of looking into an electronic camera and security system when the Navy rescinded the lease and all items remaining had to be removed.

Since we have installed a security alarm system and motion detectors at Ki`i, we have not experience any break-ins. We have had to respond to the alarm several times, but it was caused by critters crossing the sensors. Purchasing improved detectors later in the year has decreased the number of false alarms greatly.

18. Cooperating Associations

Nothing to report.

19. Concessions

Nothing to report.

I. EQUIPMENT AND FACILITIES

1. New Construction

Critical facility needs consisted of a maintenance baseyard that will provide employees a safe place to work, a conducive place to work, and will provide protection for Service equipment away from the salt air and environment as well as from thieves and vandals. Both the station safety audit and an Environmental Compliance Audit have documented violations due to the unsafe conditions in which our maintenance workers are having to work. Current conditions consist of a one-sided shed providing little to no protection from the environment. There are also no

utilities available such as clean water or electricity, creating multiple safety violations based on job requirements.



This was our only storage to protect our precious equipment from the harsh coastal environment. The new building will be a very welcome addition.

Too many tractors died a premature death due to having no shelter. With a new building, the heavy and small equipment stands a better chance of lasting a few years.



Fortunately we were able to get an MMS project funded, #91001M, for \$279,000 in order to construct the badly needed facility that will not only provide a safe and conducive work environment for maintenance personnel but will also provide essential protection for equipment from a harsh coastal environment. The facility will be complete with potable water, electricity and sewer. The contract was issued to Walker Moody and planning is underway. Construction is expected to begin in March 2003 and completed by June of next year. For the most part, all utilities (water, sewer, and electricity) were installed by maintenance staff, saving us a considerable amount of funds.



Maintenance staff installed the electric line saving a trench full of funds.



Our new electrical transformer and service station with meter.

In preparation of the new building, complete with sewer, a sewer allotment of 400 gallons per day (gpd) (one dwelling unit minimum) was requested for purchase from the Estate of James Campbell. The application to the City and County of Honolulu, Department of Planning and Permitting Wastewater Branch, was submitted and approved, and we will be able to pump directly into the Kahuku Wastewater Treatment Plant. The cost of this allocation was \$8,868.50.



Water/sewer connection at the Kahuku Wastewater Treatment Plant located adjacent to the refuge.

Maintenance staff again saved us a trench load of funds by installing both lines right up to the connection point.

Thanks to MMS funds of \$223,000, the Waiawa Unit of Pearl Harbor NWR will receive a secure water source directly from a well within the unit. In the past, the Waiawa Unit was very productive, especially for the endangered Hawaiian Stilt. It also has provided crucial wetland habitat for migratory waterbirds coming from North American, Alaska, and Asia. In the past few years, as the community changed around the unit, the need for a secure low salinity water source became *more pressing* since water is the essential element of this habitat. This need became extremely apparent this past year, when the ponds went completely dry due to a lack of water coming from the originating spring source. However, MMS funds came to the rescue

in FY02 and a contract has been issued to drill a freshwater well within the unit. The new water well will be installed in February 2003 so that this unit can once again be productive for Hawai'i's four species of endangered waterbirds.

2. **Rehabilitation**

One of the impoundment dikes have eroded almost to a point that it is no longer safe for staff to traverse in a standard vehicle or tractor, and does not meet Service standards.

Under a contract with Ducks Unlimited, our original plans were to fill, compact, and re-slope dike to 5:1. However, after a series of discussions, we determined that we will actually use the funds to lower the dike and combine two ponds, making one large contiguous pond. This will even better aid our efforts in the recovery of four species of endangered waterbirds as well as migratory shorebirds and waterfowl that rely heavily on these managed wetlands for nesting, loafing and foraging. By lowering the dike, it will no longer be traversed, eliminating the safety hazard, and will no longer need routine mowing thus reducing maintenance needs. The leg work and pond elevations have been accomplished, but repair work will not begin until after nesting season in 2003.



Dike will be lowered creating one large management pond. Work is scheduled for 2003.

Also under contract with Ducks Unlimited, we are able to improve our water delivery system substantially with the installation of a new well. The current water delivery system limits our ability to deliver water where, when, and in the quantity needed. It currently is via gravity flow, which greatly reduces our ability to provide quality waterbird habitat. Project will include the drilling of a new well and modifying the existing pipe distribution network in a manner that will eliminate current distribution problems. The system will be redesigned to allow for more control and independent filling of each pond and will include Pond E, which we have never had the ability to manage with fresh water before.

Since water is the primary factor in providing habitat for four endangered species of waterbirds as well as migratory shorebirds and waterfowl, the new water delivery system will improve not only the efficiency of water management between seven impoundments but also will double the quantity and drastically improve the speed of delivery. This critical resource protection project will enable adequate management of water levels and prevent waste, especially during the summer nesting season when there is a severe water shortage.

3. Major Maintenance

Fence repair requires constant maintenance at both of the wetland units. With the last 200 ft along our east boundary, maintenance staff have now completed replacing all of the rusted through metal “T” post of the Ki’i Unit boundary. With the longevity of the wood posts, the only frequently reoccurring project will be wire replacement (about every three years) and damage repair. Fence maintenance is critical to our mission of protecting endangered birds, primarily by keeping dogs out.



At last, all metal “T” posts have been replaced by wooden posts. This will make future fence repairs much quicker.

We are also happy with our humvee - it will get us anywhere we want to go. With the assistance of volunteer Lloyd French, we obtained three, of which one was transferred to Hakalau NWR and one to Kilauea Point NWR.

4. Equipment Utilization and Replacement

A new Kabota M9000 DTCC1 - four wheel drive tractor with A/C cab and creep gear was purchased this year to align help control the vegetation. Along with the tractor, removable dual rear tires and a rear mounted heavy duty flail mower was purchased. It replaced the John Deere 6200 farm tractor.



The new Kabota is one of our primary tools used in habitat maintenance.

A smaller John Deere 4115 - 4X4 compact tractor with ROPS, canopy, 24 hp engine, with 3-point quick attach hitch was purchased. This smaller, lighter tractor will enable maintenance staff to enter into ponds sooner, allowing for more working time before the ponds need to be refilled. A 72" mowing deck, tiller, and a rotary mower were also purchased from John Deere.



Smaller tractors such as the new JD 4115 will enable us to enter ponds for maintenance much quicker. It has already proved to be invaluable.

A Nipol rotary tiller model SX-1600 was purchased through Bacon Universal. It will be used with the Kabota. Tilling after mowing the ponds results in longer lasting control of the vegetation.



The new Nipol rotary tiller model SX-6100 has shown some very positive results.

After several months post tilling, the results are dramatically different in batis. After this test, we will definitely be using the tiller more often.



An old utility truck was excessed through GSA. The bidding was opened June 6-11 and the truck sold for about \$500. It was replaced with a Toyota Tacoma SR5 4X4; a waiver request to purchase the Toyota was approved based on a higher ground clearance, tighter turning radius, and a better warranty.

A Memorandum of Understanding between FWS Region 1 and Defense Reutilization and Marketing Service (DRMO) was established in order to return the large unusable items. This is a mechanism that will allow any Region 1 office to turn in excess items to a DRMO nationwide. CGS has a copy of the MOU, Interagency Agreement Economy Act, and DD 1144 form (one copy of each would be needed at time of turn in along with the DD Form 1348 1A form(s) for each item being turned in. In addition to several items left over from Midway Phoenix, one of our Service vehicles had to be turned in through this process because GSA refused to process it for auction. It was not worth their time and effort, making it economically unfeasible.

Several repair calls were required this year for the 40 hp pump at Ki`i that pumps the ditch water to Ki`i outlet. In June, we contracted with Pacific Electro-Mechanical, Inc. to pull the existing pump motor and replace it with a new motor.

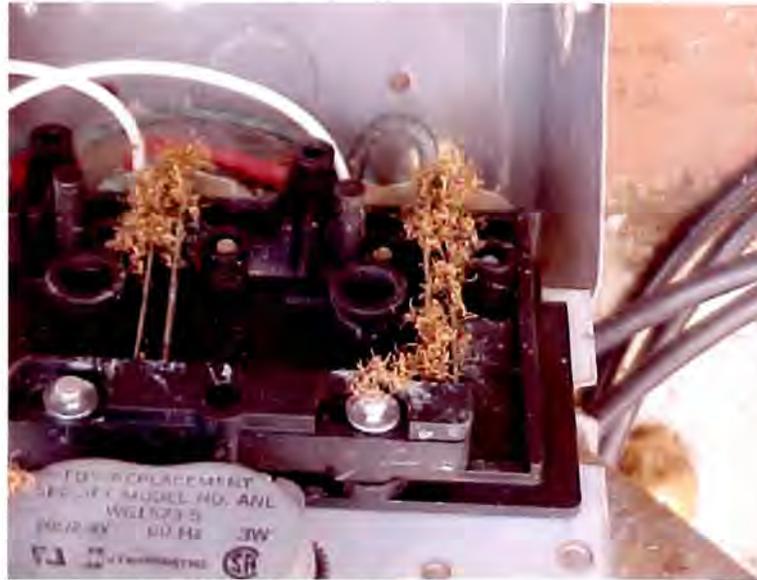


Installing a new pump at Ki`i. The removable roof allows "easy" pump extraction for maintenance.

The 40 hp pump is critical for maintaining the water level in the ditches.



A common problem with all electrical units within the wetlands is infestations of ants, geckos, roaches, and any other critter that benefits from warmer places. Baits usually keep things under control, but when not replaced, electrical shorts are often caused by a build up of insects or geckos touching the wrong places. This picture of the Honolulu pump timer shows how a bunch of ants can get fried all at once. Just one more of the many things that pop up and keep our maintenance staff busy.



Anyone for a few quick fried ants?

5. Communications

Our Nextel cell phones with direct connect still meet our needs almost perfectly. No changes are anticipated.

6. Computer Systems

Four new Dell computers were purchased this year, which included one for our LAN system. All came with a Windows XP operating system, which now that we are accustomed to the changes, we like.

A new Savin copier was purchased through a government contract and was delivered on September 18th. It has made the office life much easier for staff. This is a multifunction digital machine which works through our computer network allowing us to print, scan, and fax directly from our computer. A good copier, computer, and postage meter can make folks in the office happy.

7. **Energy Conservation**

Staff continues to recycle cans, paper, and cardboard. Local recycling bins make it convenient to drop off.

8. **Other**

Nothing to report.

J. OTHER ITEMS

1. **Cooperative Programs**

Nothing to report.

2. **Other Economic Uses**

Nothing to report.

3. **Items of Interest**

Always enjoyable is our staff Christmas party which was held on the Ali`i beach this year. A great time to enjoy Hawai`i's winter. Standing (L to R): Donna Stovall, Pam Gibson, Keahialaka Balaz, volunteer Patti Galligher-Jones, Nancy Hoffman, Maurice Blackwell. Kneeling (L to R): volunteer Kathy Hachy, Greg Smith, Mike Silbernagle, George Fisher.



Senator Akaka's Honolulu staff member Mike Kitamura came out with a D.C. staff member, Seema Balwani, for a Ki'i Unit site visit on August 14.

4. **Credit**

General information regarding weather in Hawai'i was found at www.gohawaii.com/hokeo/weather/report.html and at www.worldclimate.com.

K. FEEDBACK

Narratives are getting fewer and fewer nation-wide, as well as here on O'ahu. However, it is still a valuable tool to have on the shelf. Although it is time consuming, it is a great "one-stop shopping" resource for what's been going on, and very valuable for any incoming staff particularly for a new refuge manager. This recent narrative was one of the last "to do" items for the out-going manager, Donna Stovall. She has been selected to be the new Project Leader for the Malheur NWR in southeastern Oregon. The transfer will take place in 2003.



U. S. Fish & Wildlife Service
O'ahu National Wildlife Refuge Complex
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Find us on the web at,
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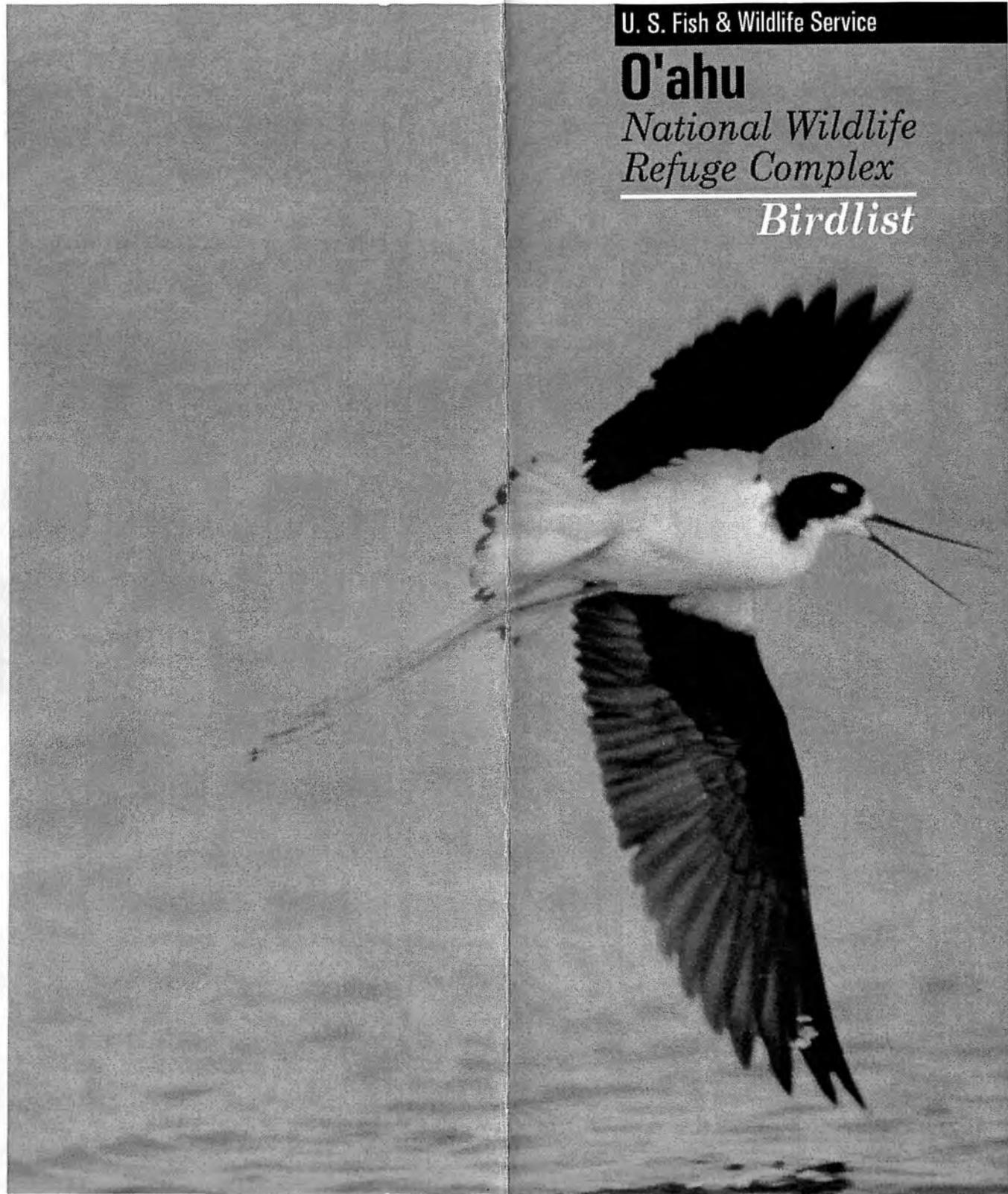


U. S. Fish & Wildlife Service

O'ahu

*National Wildlife
Refuge Complex*

Birdlist



This list contains species which have been observed on the Oahu National Wildlife Refuge Complex (James Campbell and Pearl Harbor National Wildlife Refuges) since their establishment. Species are listed in accordance with the seventh edition (1998) A.O.U. checklist.

Seasonal status, abundance, and refuge designation are coded as follows:

S—Spring: March-May
S—Summer: June-August
F—Fall: September-November
W—Winter: December-February

E-Endangered Species

c—common certain to be seen in suitable habitat
u—uncommon present, but not certain to be seen
o—occasional seen only a few times during a season
r—rare not seen annually but of regular occurrence
x—accidental not normally expected

(J) - James Campbell NWR Only
(P) - Pearl Harbor NWR Only

	S	S	F	W
ALBATROSSSES				
Black-footed Albatross (J)	x		x	x
Laysan Albatross (J)	r	x	x	u
TROPICBIRDS				
Red-tailed Tropicbird (J)	r	r	r	r
White-tailed Tropicbird (J)	r	r	r	r
BOOBIES				
Red-footed Booby (J)	x	x	x	x
FRIGATEBIRDS				
Great Frigatebird	u	u	u	u
HERONS				
Great Blue Heron (J)	x	x	x	r
Snowy Egret	x	x	x	x
Cattle Egret	c	c	c	c
Black-crowned Night-Heron	c	c	c	c
GEESE & DUCKS				
Fulvous Whistling-Duck (J)	r	r	r	r
Greater White-fronted Goose	r		r	
Snow Goose (J)	x		x	
Brant	r		r	r
Canada Goose	r		r	r
Green-winged Teal	u		u	u
Mallard	u	u	u	u
Hawaiian Duck E	c	c	c	c
Northern Pintail	u	x	u	
Garganey	r		r	r
Blue-winged Teal	r	x	r	u
Cinnamon Teal	x	x	x	x
Northern Shoveler	u	x	u	c
Gadwall	x		x	x
Eurasian Wigeon	r		r	r
American Wigeon	r	S	F	W

Canvasback	r	r	r	
Redhead (J)	x	x	x	
Ring-necked Duck	r	r	u	
Tufted Duck	x	x	r	
Greater Scaup	x	x	r	
Lesser Scaup	r	r	u	
Bufflehead	r	r	u	
Common Merganser (J)	x	x	x	x
HAWKS				
Osprey	r	r	r	r
Northern Harrier	x		r	x
FALCONS				
Peregrine Falcon	x	x	r	r
PHEASANTS				
Erckel's Francolin (P)	u	u	u	u
Ring-Necked Pheasant	u	u	u	u
GALLINULES & COOTS				
Hawaiian Moorhen E	u	u	u	u
Hawaiian Coot E	c	c	c	c
PLOVERS				
Black-bellied Plover	u	x	r	u
Pacific Golden-Plover	c	r	c	c
Semipalmated Plover	r	x	u	r
Killdeer	x	x	x	x
STILTS				
Hawaiian Stilt E	c	c	c	c
SANDPIPERS & WADERS				
Greater Yellowlegs	r		r	r
Lesser Yellowlegs	r		o	r
Solitary sandpiper			x	
Wandering Tattler	u	o	u	u
Gray-tailed Tattler (J)	x	x	x	x
Spotted Sandpiper			x	
Whimbrel (J)	r		r	x
Bar-tailed Godwit (P)				x
Black-tailed Godwit				x
Bristle-thighed Curlew (J)	r	x	o	r
Ruddy Turnstone	c	o	c	c
Red Knot (J)			x	x
Sanderling	u	x	u	c
Semipalmated Sandpiper	x		x	x
Western Sandpiper			r	
Red-necked Stint (J)	r		r	r
Least Sandpiper	r		o	r
Pectoral Sandpiper	r		u	r
Sharp-tailed Sandpiper	r		u	r
Dunlin (J)	o		o	u
Curlew Sandpiper (J)	x		x	x
Buff-breasted Sandpiper (J)				x
Ruff	x		x	r
Short-billed Dowitcher			x	x
Long-billed Dowitcher	o		o	u
Stilt sandpiper			x	x
Common Snipe	r		r	r
Wilson's Phalarope			r	
Red Phalarope (J)	r		x	x
	S	S	F	W
GULLS & TERNS				
Laughing Gull	r	x	r	r
Franklin's Gull	x			
Bonaparte's Gull	r		r	u
Ring-billed Gull	r	r	r	u
Herring Gull				r
Western Gull (J)				x
Glaucous-winged Gull (J)	r		r	o
Gull-billed Tern (P)	x	x	x	x
Caspian Tern (J)	x	x	x	x
Sandwich Tern (J)				x
Common Tern				r
Arctic Tern (J)	r		x	
Least/Little Tern	x		r	x
DOVES				
Rock Dove	u	u	u	u
Spotted Dove	c	c	c	c
Zebra Dove	c	c	c	c
PARROTS				
Red-crowned Parrot	u	u	u	u
Yellow-headed Parrot	o	o	o	o
BARN OWLS				
Barn-Owl	o	o	o	o
TYPICAL OWLS				
Short-eared Owl	o	o	o	o
MOCKINGBIRDS & THRASHERS				
Northern Mockingbird (P)	u	u	u	u
LARKS				
Sky Lark (P)	u	u	u	u
BULBULS				
Red-vented Bulbul	c	c	c	c
BUSH-WARBLERS & BABBLERS				
Japanese Bush-Warbler	o			o
White-rumped Shama	u	u	u	u
MYNAS				
Common Myna	c	c	c	c
WHITE-EYES				
Japanese White-eye	c	c	c	c
CARDINALS				
Northern Cardinal	c	c	c	c
Red-crested Cardinal	o	o	o	o
FINCHES				
House Finch	c	c	c	c
OLD WORLD SPARROWS				
House Sparrow	o	o	o	o
WAXBILLS & MANNIKINS				
Common Waxbill	u	u	u	u
Red Avadavat	u	u	u	u
Nutmeg Mannikin	c	c	c	c
Chestnut Mannikin	o	o	o	o
Java Sparrow	o	o	o	o