HAWAIIAN WETLANDS

NWR COMPLEX

NARRATIVE REPORT

HONOLULU, HAWAII

CY 1986

U.S. Department of the Interior

Fish and Wildlife Service

HAWAIIAN WETLANDS NWR COMPLEX

ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

WETLAND REFUGES PERSONNEL 1986

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REVIEW AND APPROVALS

Stewart A. Fefer — 2-18-88
Submitted by Refuge Complex Manager — Date

Jerry J. Leinecke — 2-19-88
District Supervisor Review — Date

Allan Marmelstein — 19 Feb 88
Pacific Islands Administrator Review — Date

Sanford R Wilbur — 2/23/88
Regional Office Review — Date

PACIFIC ISLANDS OFFICE, REFUGES AND WILDLIFE STAFF

(L-R) Dick Wass, Allan Marmelstein, Molly Jones, Steve Berendzen, Kathy Castelo, Paul Chang, Shirley Hernandez, Stewart Fefer, Anne Robb, (Ken) Duane McDermond, Jerry Leinecke, Darcy Hu, James Krakowski

HANALEI NWR

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Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

Hanalei NWR was established in 1972 and consists of 917 acres of river bottom land, taro farms, and wooded slopes in the Hanalei Valley on the north coast of Kauai, Hawaii. The seasonally flooded plots, Hanalei River, and taro patches provide habitat for four species of endangered waterbirds and other wildlife. Taro farmers are under Special Use Permit and farm approximately 150 acres of the refuge. This is an unmanned station that is administered from the Honolulu office.

Hanalei National Wildlife Refuge is located in the lower portion of Hanalei Valley. Hanalei Bay is visible in the background. (SB)

HANALEI NATIONAL WILDLIFE REFUGE

F. HABITAT MANAGEMENT

G. WILDLIFE

H. PUBLIC USE

H. PUBLIC USE (Cont.)

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

The 20 acre wetland impoundment was fenced and de-watered to facilitate grazing for use as a management tool in hopes of eradicating noxious California grass. It is anticipated that grazing will also compact the dikes to reduce leakage (Sec. F.2).

A question has been raised several times in the past regarding ownership of the houses used by taro permittees on the Refuge. The opinion from the Regional Solicitors office was that the taro permittees own the houses, but the FWS has control over modifications to the size or exterior appearance of houses on Hanalei National Wildife Refuge (Sec. C.3 & E.7).

Fish were collected from various wetland areas on the refuge for contaminant analyses. Results of analyses for organochlorines and heavy metals will be compared with other refuges, and should provide a baseline for future concerns (Sec. D.5).

B. CLIMATIC CONDITIONS

A dry winter was followed by a wet spring and summer. Heavy November rains caused major flooding of Hanalei River, resulting in inundation of taro fields and grazing pastures. Some taro fields were partially destroyed, and some fences were washed out. Flood waters removed some matted clumps of California grass that had been encroaching into the river.

The following weather data were recorded at Princeville Ranch weather station, 1/2 mile north of the refuge. This station is nearest Hanalei Refuge and provides the most representative weather.

1986 RAINFALL DATA FOR HANALEI NWR

Month	Amount (inches)
January	1.26
February	2.54
March	7.10
April	6.23
May	6.30
June	5.27
July	8.03
August	14.55
September	10.65
October	4.46
November	17.89
December	6.00
Total Annual Rainfall	90.28
Mean Monthly Rainfall	7.52

C. LAND ACQUISITION

3. Other

The question of ownership of taro permittees houses has surfaced several times in the past few years. The Honolulu office has asked for a decision from the Regional Solicitors office, and in March Richard DeClerck met with a Princeville Corporation attorney and obtained information regarding the property transfer to the FWS. The result from the Solicitors office was the opinion that taro permittees own the houses, but the refuge can regulate improvements regarding size and external appearance of the dwellings.

The Hanalei Valley has been nominated by the state for placement on the National Register of Historic Sites, so building and facility improvements must be performed mindful of historic preservation.

D. PLANNING

1. Master Plan

A final draft of the Wetland Master Plan was submitted to the Regional office in November. The Wetlands Master Plan contained specific development needs for each wetland refuge, including Hanalei NWR. This plan will be reviewed by the Regional Office and submitted to state and local agencies for further review and comment.

2. Management Plan

A final draft of a Sport Fishing Plan and Environmental Assessment of fishing impact on Hanalei Refuge was submitted to the Regional office in January, and was aproved in May. These plans were also announced in the Federal Register to formally implement the fishing plan.

4. Compliance with Environmental Mandates

A Senate bill proposing to fund $25,000 for restoration of the interior of the Hoopulapula Haraguchi Rice Mill was passed during the last 2 weeks of December. The rice mill is on the State of Hawaii and National Register of Historic Sites, and it will have improvements made after funding begins in January 1987.

A satellite dish antenna was discovered at the residence of a taro permittee on Hanalei Refuge in March. The antenna was in violation of the historic integrity of Hanalei Valley and the permittee was required to remove it.

5. Research and Investigation

Habitat improvements were planned for the 20 acre impoundment. Eradication of California grass should be followed by establishment of wetland vegetation that is preferred by endangered waterbirds for production and maintenance habitat, and is also easier to maintain. Monitoring of waterbird use and invertebrate responses should also be conducted.

Monitoring of moorhen nesting was conducted when nests were reported by taro permittees or encountered by refuge staff. It was believed that many nests were not being reported by taro farmers.

Fish were collected from Hanalei wetlands during the summer of 1986 for tissue samples to be used for contaminant analyses. Samples of swordtails were taken from a moist-soil impoundment, ahole'hole were taken from a taro effluent ditch, and gobies were collected from Hanalei River. Various water bodies were sampled in an attempt to detect contminant differences; however, the same species of fish could not be collected from each water body for consistency.

These tissue samples will be analyzed for organochlorines and heavy metals to detect levels available to endangered waterbirds. These samples should also provide a baseline for future contaminant surveys.

E. ADMINISTRATION

2. Youth Programs

A YCC group from Kilauea Point NWR assisted the wetland manager with clearing vegetation for a fenceline around the 20 acre wetland impoundment. The YCC crew also assisted with some fence construction and helped clear vegetation from an irrigation ditch that supplies water to the impoundment.

3. Other Manpower Programs

A Special Use Permit grazer provided most of the labor for installing a fence around the 20 acre wetland impoundment. The FWS provided fencing materials and the grazer provided a fencing crew to install most of the fence, and a small dozer to clear much of the fenceline.

The grazer completed the fence in late December and will graze the impoundment with cattle while it is drained to eradicate exotic vegetation and compact the dikes.

A dirt road leading to 3 taro parcels and the 20 acre impoundment was improved in August by spreading 80 tons of crushed coral on it. One taro permittee spread and levelled the coral, and all 3 permittees contributed to the cost of this improvement.

5. Funding

Little funding was spent on development or improvements at Hanalei Refuge this year due to lack of manpower at this station and limited funding. Coral rock was purchased for a road totalling $1,200 that the FWS paid.

7. Technical Assistance

Richard DeClerck, from the Regional Solicitors office, met with a Princeville Corporation attorney and obtained information enabling him to provide an opinion of ownership of houses used by taro permittees. The Solicitors opinion was that taro permittees own the houses they live in on the refuge.

Some taro permittee houses on Hanalei Refuge are substandard compared to mainland standards. Currently, an effort is being made to require improvements so dwellings comply with county code.

8. Other Items

A refuge revenue sharing check for $12,552 was presented to Kauai Mayor Kunimura by PIA Marmelstein on June 6. This amount was based on .75% of the appraised land value of Hanalei and Huleia refuges; howver, only 64% of the full amount was appropriated, resulting in the payment.

A corrective action plan for specialized uses concerning taro permittees use of houses on the refuge without paying rent was sent to the Regional office in September. The taro permittees pay a fee for the land they farm and reside on, but based on the Solicitors opinion, the permittees own the houses so the Service cannot charge rent for the house.

The Complex Manager attended a public hearing to present testimony against a proposed boat dock facility on the Hanalei River. the Service feared that impacts from increased activity on the river would threaten endangered waterbirds.

Princeville Corporation presented development plans at a community meeting in Kilauea. Service staff attended the meeting, raised questions and presented concerns regarding potential impact to the Hanalei overlook and interpretive site.

F. HABITAT MANAGEMENT

1. General

This 917 acre refuge consists of river bottom land, taro farms, and wooded slopes in the northern end of Hanalei Valley. The primary wetland habitat is taro fields (120 acres), located on both sides of the Hanalei River. The 4 to 6 inch water depth maintained by taro farmers provides habitat for the four endangered Hawaiian waterbirds: stilt, coot, moorhen, and duck.

The river that flows north through the middle of the refuge also provides wetland habitat. A 20 acre impoundment provides additional wetland habitat, and eventually more grassland in this valley will be converted to wetland habitat.

The forested slopes (458 acres) along most of the refuge perimeter provide an excellent buffer zone for the wetland.

Aerial photographs were taken of Hanalei Refuge along with other wetland refuges in June. Aerial photos will be transcribed onto maps to update mapped locations of taro fields, the new impoundment and residences.

Taro fields provide a mosaic pattern to the valley floor of the refuge. New moist-soil impoundments should add additional interspersion of various wetland types. (RAC)

2. Wetlands

The 20 acre impoundment is presently choked with California grass that covers 95 percent of the surface area. However, it is hoped that cattle will soon graze the California grass, allowing it to be flooded and drowned following grazing. An adjacent grazer agreed to fence the area if the Service provided materials and some labor. The fencing was finished in late December, and it is hoped that the exotic vegetation will soon be eradicated and dikes will be compacted.

Removal of California grass and establishment of more beneficial plant species will hopefully make this impoundment a viable production area for endangered waterbirds.

The Hanalei River, effluent and delivery ditches, and taro fields also provide wetland habitat for the endangered waterbirds, but most of this habitat Hawaiian coot, stilt and duck are
uncommon nesters at Hanalei Refuge, but more Service managed wetland impoundments should provide good production habitat.

4. Croplands

No official requests for additional taro land were received this year, but some permittees commented that they would like more land. Charles and Diane Spencer requested to partially move into an adjacent parcel relinquished by Mrs. Alapai last year. The Alapai parcel is on higher ground, and gets flooded less frequently by Hanalei River. Permission for the Spencers to farm part of the adjacent parcel was granted as long as the total acreage farmed does not exceed the amount specified in their permit.

Typical damage from coots occurred to young taro plants during the winter. Some farmers put up chicken wire fencing to exclude the birds from recently started fields where damage is typically greatest. Some farmers suffer the loss and accept the damage as one of the costs of farming on the refuge. Despite the loss to coots, most farmers feel the farming is profitable and they appear tolerant of the waterbirds.

7. Grazing

Approximately 132 acres of grazing land exist on Hanalei NWR. Currently, three grazing permits are used on the Refuge: Mahuiki (26.14), Tai Hook (17.5), and Princeville Cattle Company (88.0). The total Animal Unit Months grazed on Hanalei during 1986 was approximately 1,700 at $1.25 per AUM.

The main benefit of grazing to refuge management is providing close-cropped pasture as seasonal habitat for waterbirds. Problems caused by grazing include damage to crops, irrigation structures, or endangered waterbird nests from cattle that escape fenced areas.

Princeville Cattle Company cooperated with the Service by fencing the 20-acre impoundment with the intent of grazing it for the benefit of the Service as an experimental method of vegetation control. Grazing would also convert the nutrients currently tied up in dense grass into a more accessible media, and compaction of the pond dike should result from cattle use. The grazer would benefit from the forage provided to his cattle during the initial grazing attempt and any other attempts that may be needed later. Grazing should also be a good method of controlling vegetation on pond dikes even when the pond is full.

The pasture used by Mahuiki was being overtaken by exotic vegetation in some areas, so he was instructed to clear large patches of trees and brush in January. Much clearing was done through the summer, but intermittent rains hampered his efforts.

10. Pest Control

Dogs and cats appear to be the worst predators of endangered waterbirds on Kauai. Five adult cats were removed throughout the year in addition to one litter of kittens.

Wild chickens or "jungle fowl" cause problems to taro by pecking holes in taro corms, thus allowing invasion of bacteria and fungus that rot the corm. Approximately 100 wild chickens were shot by refuge staff throughout the year.

G. WILDLIFE

2. Endangered and/or Threatened Species

Four endangered species of waterbirds use Hanalei NWR: Hawaiian stilt, coot, moorhen, and duck.

Waterbird censuses are conducted from two overlook locations above the valley with a high powered telescope. Taro provides a dense cover that frequently obscures viewing of waterbirds; however, previous research estimated the proportion of birds visible from counts relative to the actual population determined from intensive transects and surveys. A conversion factor was determined for each species to more accurately estimate populations.

Hawaiian Duck: This species is difficult to count for several reasons. There is considerable crepuscular movement throughout the valley, perhaps to mountain streams off the refuge during days, but back to safe roosting areas (such as the refuge) during the night. Also, birds tend to be solitary or in pairs, so scattered individuals near dense cover are difficult to detect. As a result, refuge counts are of questionable accuracy. There was no clear population trend during the period, and refuge counts were variable throughout the year. Differential use was observed between taro and the wetland impoundment, but composite refuge counts ranged from 22 to 149 birds suggesting a slight increase in the population. No nests were reported during 1986, but 3 broods were observed, and estimated production was 24 birds.

The koloa population on Hanalei NWR has increased considerably since the late '70s and early '80s when average counts yielded 10 to 25 birds. (SB)

Hawaiian moorhen: Moorhens are relatively secretive and, therefore, difficult to count. A peak estimate of 80 birds was obtained in May, and average estimates were about 30. Only 8 nests were reported in 1986 in the dense taro patches. Five nests appeared successful at hatching, and at least 4 broods successfully fledged. Nesting is expected to be more common than indicated; it is felt that many taro farmers are not accurately reporting nests.

Hawaiian Coot: The coot population was variable and ranged from 16 to 157 with no obvious seasonal trends. The average population was approximately 70 birds. No nesting was reported on the refuge, but coot broods were observed on Hanalei River adjacent to the refuge.

Hawaiian stilt: Stilt numbers are also quite variable at Hanalei Refuge. The winter population was low and sometimes no stilts were seen. Up to 105 stilts were observed during summer and fall. Nesting at Hanalei is restricted to narrow dikes between taro fields. Four stilt nests were reported in June and July, much later than normal. Two pairs appeared to successfully fledge young.

3. Waterfowl

In addition to the native Hawaiian duck, one fulvous whistling duck was frequently sighted and incidental sighting of other waterfowl were as follows:

	January	February	December
Northern Shoveler	14		
Northern Pintail	22	4	
Green-winged Teal	2		
American Wigeon			1

In 1984 and '85 fulvous whistling duck families were occasionally observed at Hanalei; in 1986 only 1 individual was seen. It is possible that the other whistlers emigrated to Oahu or another island.

4. Marsh and Waterbirds

Black-crowned night herons occurred regularly on the refuge, and counts averaged 8 birds. The heron is known to take chicks and eggs of endangered waterbirds, and evidence from stilt and moorhen nests suggests that herons may have a significant impact on waterbird production.

Cattle egrets have also been suspected of preying on endangered waterbird eggs and young. This aggressive, introduced species concentrates its feeding in areas of disturbance, and more recently in shallow wetlands on the refuge. An average of approximately 40 birds was seen in 1986, compared with a 1985 average of 10 birds.

5. Shorebirds, Gulls, Terns, and Allied Species

Lesser golden plovers winter on Hanalei NWR, with numbers averaging 7 birds. Wandering tattlers are sometimes seen in open taro ponds. Occasional migrant visitors were documented; six dowitchers and one lesser yellowlegs were seen in December.

Lesser Pacific golden plovers winter in Hawaii; Hanalei taro provides habitat for some of these migrants. (SB)

6. Raptors

A pair of Hawaiian short-eared owls was occasionally seen hunting the grasslands, and a barn owl was also heard and seen periodically.

11. Fisheries Resources

The aquatic fauna in Hanalei National Wildlife Refuge is found in the taro fields, adjacent wetlands, and the Hanalei River. Many of these species are food sources for the endangered waterbirds. The waterbirds are attracted to chironomids (midges) and tubificids (worms), that exist in the taro fields. Chironomids are abundant in shallow water, while tubificids can flourish in wet and dry environments. Bird feeding is most intensive during the wet fallow period of the taro agricultural cycle, between harvesting and replanting of the taro fields. Endemic and exotic gastropod mollusks (snails, slugs, etc.), as well as toads and bullfrogs, inhabit some of the taro fields and ponds.

In a recent aquatic survey, the Hanalei River was found to have a substantial population of native aquatic species. The Hanalei River not only yielded the greatest number of endemic species in the streams surveyed (based on the number of mountain shrimp per sampling station), but also had the highest percentage of endemic species sampled (74%).

Four species of native o'opu (gobies) are known to inhabit the streams and ponds of Hanalei Valley. These are o'opu nakea (Awaous stamineus), o'opu nopili (Sicydium stimpsoni), o'opu naniha (Awaous geniuttatus), and o'opu okuhe (Eleotris sandwicensis).

O'opu nakea is the largest goby, and is commercially valuable. The spawning season usually occurs between July and November, corresponding with periods of storm flows in the river. Adult o'opu nakea are washed down to estuarine areas where spawning occurs. The other species of o'opu are believed to spawn year-round at any location of the river.

The opae kala'ole (Atya bisulcata), fresh water mountain shrimp, is endemic to the Hawaiian Islands. It is described as a detritivore, consuming suspended organic particles, and it generally inhabits the middle and upper portions of streams. Opae have a diadromous life cycle, requiring access to seawater to spawn. Spawning takes place year-round, suggesting a multivoltine life cycle known for many other tropical species.

Other aquatic fish inhabiting the refuge include tilapia (Tilapia spp.), mosquito fish (Gambusia affinis), and swordtails (Xiphophorus spp.). Fish species inhabiting or spawning in the estuary and brackish waters of the Hanalei river include papio (Caranx sp.), mullet (Mugil cephalus), barracuda (Sphyraena barracuda), milkfish (Chanos chanos), and aholehole (Kuhlia sandwicensis). The brackish waters also provide habitat for a number of species of crabs.

H. PUBLIC USE

2. Outdoor Classrooms - Students

Four groups of students visited Hanalei NWR during spring and early summer. Total number of students was 316 during 1986 with educational emphasis on endangered species, and historic preservation of the taro farming culture.

6. Interpretive Exhibits/Demonstrations

A panel display at the Hanalei Valley overlook constructed in 1980 continues to provide information on taro and on the endangered Hawaiian waterbirds found in Hanalei NWR. Approximately 555,000 people viewed the refuge and had access to interpretive panels in 1986.

9. Fishing

Hanalei River attracts recreational and part-time commercial fishermen who fish mainly for several species of gobies. Fall or early winter storms that create heavy stream flows induce one goby, the o'opu nakea, to go downstream to spawn in estuaries. Commercial fishermen set nets across Hanalei River to harvest tons of these fish annually. Nets frequently break loose and are washed downstream and out to sea, thus causing potential problems for other fish and marine life.

Unfortunately, the recreational fishermen who do the bulk of the fishing in Hanalei River catch only a small portion of the fish harvested. Commercial fishermen take a disproportionate amount of fish in only a few days each year. Recreational fishermen have indicated a decrease in fishing success over the past few years.

Sport Fishing Plan for Hanalei NWR incorporated the state fishing regulations to be applied to refuge fishing, but the plan also expressed concern over some of the commercial fisheries uses of Hanalei River.

16. Other Non-Wildlife Oriented Recreation

Hanalei River has 2 small boat harbors in the estuary. Many of these boats give tours of Na Pali coast or whale-watching. Upon returning to Hanalei River, many boats run upstream to flush saltwater from their engines. This increase in boat traffic could have adverse impacts on waterbird usage of the river as well as on the fisheries resource.

I. EQUIPMENT AND FACILITIES

1. New Construction

Taro permittee Flora Mateo continued revising plans for reconstruction of the dwelling on her taro parcel. Construction by Mateo had been stalled because plans were not in compliance with County building code.

3. Major Maintenance

The ditch providing water to the 20 acre wetland impoundment was cleared of vegetation and substrate that had fallen in from the adjacent hillside. An effluent ditch was also sprayed periodically to control exotic vegetation.

The road leading to the wetland impoundment and 3 taro permittee parcels was given a coat of crushed coral rock in August. Wet conditions typically keep this road saturated allowing ruts and holes.

J. OTHER ITEMS

1. Cooperative Programs

Ken Niethammer, research assistant with the University of Missouri endangered waterbird study, visited Hanalei Refuge in November and discussed potential research with management applications. Much of the information discovered by University of Missouri research on Oahu is applicable to wetland management at Hanalei.

It is beleived that taro provides good maintenance habitat for endangered waterbirds, but more production habitat is needed. Additional wetland impoundments could be constructed in pasture and fallow areas to provide good habitat for all 4 endangered species throughout the year, in addition to migrants.

2. Other Economic Uses

University of Hawaii researcher Dr. Ramon Dela Pena is studying different varieties of taro in an attempt to find additional marketing outlets. Dela Pena farms a parcel of taro land on Hanalei Refuge for his research activities. Potential markets for taro products are taro chips and taro flour for pancakes or other baked goods and baby food. Taro leaves are also eaten and used as traditional wrappings for some foods.

4. Credits

Steve Berendzen wrote this narrative.

HULEIA NWR

ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

The Huleia NWR consists of 238 acres of river bottom land and wooded slopes in Huleia Valley near the Menehune (Alakoko) Fish Pond west of Nawiliwili Harbor on the east shore of Kauai, Hawaii. Huleia NWR was established in 1973 to provide habitat for Hawaii's four species of endangered waterbirds. This is an unmanned station that is administered by staff from the Honolulu Complex office. Waterbird use is minimal due to limited wetland area on the refuge. However, wetland development plans, which rank high in the region, could dramatically increase waterbird use and production if development were implemented.

This view of Menehune Fishpond is from the high ridge extending into Huleia Refuge. The Refuge adjoins the near side of Menehune Fishpond, and extends well behind the site where this photograph was taken. (RW staff photo)

HULEIA NATIONAL WILDLIFE REFUGE

F. HABITAT MANAGEMENT

G. WILDLIFE

H. PUBLIC USE

H. PUBLIC USE (Cont.)

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

Plans for the proposed impoundment development of Huleia NWR were completed by Wilson Okamoto and Associates (Sec. D.1).

Fish were collected from two sites on the refuge for organochlorine and heavy metal contaminant testing (Sec. D.5).

B. CLIMATIC CONDITIONS

No major storms occurred during 1986, and rainfall was lower than normal throughout the year. Weather data recorded at Lihue Airport is most representative of Huleia Refuge.

1986 RAINFALL AND TEMPERATURE DATA FOR HULEIA NWR

		Average Daily Temperatures	
Month	Rainfall	Low	High
January	0.30	64.3	77.9
February	1.02	61.8	80.7
March	2.02	67.3	79.3
April	1.95	71.2	79.6
May	2.59	71.4	81.2
June	1.85	73.3	82.3
July	3.20	75.0	84.0
August	2.97	76.2	84.1
September	2.85	74.2	86.0
October	1.98	73.2	84.1
November	1.49	69.7	84.5
December	2.86	64.2	81.5
TOTAL ANNUAL RAINFALL	27.08		
MEAN MONTHLY RAINFALL	2.26		

C. LAND AQUISITION

1. Fee Title

A land trade was made late in 1985 between the service and the heirs of the Kanoho estate. This transaction was followed in early 1986 by a visual survey of new refuge boundaries, and refuge signs were replaced to reflect these changes.

3. Other

LaFrance Kapaka visited the refuge office in February. She is one of the owners of the Ching Exchange kuleana. She requested the status of her 1978 SUP to build a house on Huleia refuge. In March, Scott Wise (RO-ACQ) called her in Alaska and told her that the permit was no longer valid since the exchange did not occur back in 1978 as planned.

D. PLANNING

1. Master Plan

Refuge Manager Krakowski and Bill Striplin (RO-EN) met with Wilson Okamoto and Asociates on April 15 to discuss the preplanning of construction projects at Huleia.

On April 16, Refuge Manager Krakowski, Bill Striplin (RO-EN), and a Wilson Okamoto and Associates representative visited the refuge. Wilson Okamoto had the preplanning contract for future impoundment work at Huleia refuge and this trip was a field orientation for the representative.

Engineers from Wilson Okamoto and Associates visited Huleia with refuge staff on July 23 to collect field samples of soil and water and to make field observations for planning the proposed development of wetland impoundments for this refuge.

Supervisory Civil Engineer Striplin, and Hydrologist McVein from the Regional Office and Refuge Manager Berendzen met with Wilson Okamoto engineers on October 21 to discuss finalizing development plans for the refuge. Drafts of development plans were submitted in October, November, and December, with the final product being near at hand.

5. Research and Investigation

Waterbird population counts were conducted monthly to provide information on waterbird usage of the limited wetland habitat in this area.

Fish were collected from Huleia River and Papakolea Stream for contaminant sampling on July 23, August 28, and in October by refuge staff. Backpack shockers, scoop nets, and seines were used in fish collection.

Backpack shocking was the only adequate fish collection technique that could be used in the rocky streams at Huleia Refuge. (SLB)

E. ADMINISTRATION

1. Personnel

In October 1985, Steve Berendzen was hired as assistant Refuge Manager (Wetlands) to be stationed on Hanalei NWR for management of Hanalei and Huleia refuges. Logistical problems prevented the anticipated move to Kauai, and the Assistant Manager remained at the Honolulu office through 1986.

2. Youth Programs

While conducting a survey in May, the Refuge Manager met with some individuals from the Hawaii State Department of Education. They were interested in having school groups visit Huleia Refuge. It was suggested that they contact the complex office prior to coordination of any tours.

7. Technical Assistance

On June 6, 1986, Mr. Allan Marmelstein, the Pacific Islands administrator for the Fish and Wildlife Service, presented a check to Kauai Mayor Kunimura for $12,552.00 that represented Kauai County's 1985 share of the Refuge Revenue Sharing Act for the Hanalei and Huleia National Wildlife Refuges. The payment represents .75% of the land's fair market value; however, only 64% of the total amount was appropriated by Congress for these funds, so only that portion was paid to the county.

F. HABITAT MANAGEMENT

2. Wetlands

The refuge was acquired in 1973 to serve as a wetland refuge for four species of endangered Hawaiian waterbirds: Hawaiian moorhen, Hawaiian stilt, Hawaiian coot, and Hawaiian duck (koloa). Land use patterns in the area included various forms of agriculture including rice, taro, starch, and more recently, grazing.

Drainage ditches were previously constructed to reclaim portions of this former wetland. At present, the ditches and seasonally flooded lowlands provide only marginal wetland habitat.

No operational or new construction funds were available to develop wetland impoundments, so little wetland management has been done.

7. Grazing

Grazing permittee Lara had a total of 476 AUM's for the 158 acre grazing area. He was charged $1.25 per AUM. Lara has been battling noxious vegetation in the grazing permit area, but catsclaw (*Caesalpinia sepiaria*), an exotic legume with double rows of thorns on each branch, appears to be overtaking some areas.

Catsclaw is an exotic plant that is difficult to control, and apparently has no natural control agent. The thorny armor precludes working or moving through areas of this vegetation. (SLB)

G. WILDLIFE

2. Endangered and/or Threatened Species

The refuge was created to provide habitat for the endangered Hawaiian moorhen, coot, stilt, and duck. Huleia NWR provided limited habitat for an average of six Hawaiian ducks, and an occasional Hawaiian coot or moorhen was observed during censuses conducted along Papakolea Stream. Active habitat manipulation will be necessary to convert the refuge into productive endangered waterbird habitat.

The koloa or Hawaiian duck is the principal endangered species that utilizes wetland habitat at Huleia NWR. Mountain streams on Kauai apparently provide the best nesting and brood habitat. (SLB)

4. Marsh and Waterbirds

The average population of introduced cattle egrets was 43 in 1986. This average is more than twice the amount observed in 1985. Only two Black-Crowned Night Herons were sighted on the refuge in 1986.

The most common waterbird using Huleia Refuge is the cattle egret; they typically use upland pasture areas. Egrets have expanded their range throughout Hawaii, and apparently have little competition and few predators. (SLB)

5. Shorebirds, Gulls, Terns, and Allied Species

During the winter of 1986, 6 Lesser Golden Plover were sighted on Huleia NWR.

6. Raptors

An osprey was occasionally seen flying over Huleia Refuge, or perched overlooking Huleia River or Menehune Fishpond.

H. PUBLIC USE

Due to the undeveloped status of the refuge, isolation from main roads, and poor access roads, the public is not encouraged to visit Huleia Refuge.

1. General

Visitors view historic Menehune Fishpond from a roadside overlook on the nearby public highway. The lower reaches of Huleia Refuge can also be observed from this location. It was estimated that approximately 36,000 people stopped at this overlook to view the fishpond and refuge in 1986, and over 300 people photographed the area.

7. Other Interpretive Programs

Special Use Permittee, Kauai River Adventures, led kayak tours along Huleia River. Information on the NWR system and the purpose of Huleia Refuge are included in the tour narrative. A total of 6,128 kayakers passed through the refuge in 1986, representing a slight decrease in use from 1985.

The refuge complex office was notified of a problem with the commercial activity of Kauai River Adventures, because they were not paying a fee for the commercial use of their Special Use Permit. A fee was determined that would cover costs of administering the permit and a corrective action plan was submitted to the Regional Office in September to document this change.

Kauai River Adventures provides some interpretive information on Huleia Refuge to the several thousand tourists that are taken upriver by kayak, annually. (RW Staff Photo)

9. Fishing

Recreational fishing and crabbing is restricted to access by boat on Huleia River. The amount of pressure on fisheries resources in this stream is unknown, but small boat traffic on the river has apparently increased in recent years according to the state fishery biologist.

16. Other Non-Wildlife Oriented Recreation

The Huleia River Valley has been designated as a noise sensitive area by the Federal Aviation Administration. However, there has been a noticeable increase in helicopter use of this area. Helicopter tours are popular with Kauai visitors, and much air traffic passes through Huleia Valley over the refuge.

I. EQUIPMENT AND FACILITIES

1. New Construction

Extensive planning for wetland impoundment development for waterbird habitat was conducted throughout 1986. Initial estimates for approximately 100 acres of moist-soil impoundments ranged from 12 to over 30 million dollars. With the assistance of regional engineers, the engineering firm was convinced that impoundment development could be done less elaborately and more efficiently. The revised estimate is slightly over 1 million dollars.

The marginal habitat provided by the existing condition of the refuge is of little use compared to the potential that could be provided if moist-soil impoundments were developed. The refuge could become a primary core area for endangered species production with additional maintenance habitat provided in outlying areas.

Impoundment development was designed to minimize the maintenance requirements of this refuge with a good mechanism for regulating water levels and practicing moist-soil management. With limited wetland acreage potential on this refuge, it will have to be developed to maximize wetland area and be as labor efficient as possible.

J. OTHER ITEMS

1. Cooperative Programs

A research Biologist working on endangered waterbirds in Hawaii from the University of Missouri visited Huleia NWR with the Refuge Manager in November. The area was walked and surveyed to assess the potential problems and benefits of constructing impoundments and practicing active management for waterbird habitat.

2. Other Economic Uses

Special Use Permittee, Kauai River Adventures, was issued a revised permit and charged a $500 fee to cover the cost of administering their permit and to pay part of the travel expenses to monitor use of the area by their commercial operation.

4. Credits

Paul Chang and Steve Berendzen wrote this narrative.

K. FEEDBACK

Very few projects were undertaken at Huleia Refuge in 1986, and without implementation of moist-soil impoundment development it may not be worthwhile to expend much effort in improving the resource on this refuge. However, a lot of time was spent dealing with the engineering firm that was supposed to provide development plans for impoundment construction and a water delivery system.

The engineering firm was provided detailed sketches of impoundment layout and the suggested construction methodology, but much of the basic plan design was changed to provide "pretty" ponds that would be as tight as swimming pools. The Service cannot afford to spend millions of dollars on lining ponds with butyl rubber (aside from being totally impractical, they would inhibit emergent growth) nor can the Service afford to ship barges full of Bentonite clay to line pond bottoms and dikes.

After several meetings with the engineering firm, it was understood that the engineering representatives would not listen to a mere Refuge Manager, so a meeting was arranged for the next visit by regional engineers. Fortunately, the regional engineers convinced the contracted firm that simple earthen ponds were adequate for Service purposes.

The end result was fancier drawings of plans the Service submitted with a few specs and some (apparently) inflated cost estimates. The funding expended for these services seemed outrageous, and the time expended by Service staff was also extensive. In retrospect, more coordination with the regional engineers should have been done, but logistics make it difficult to get prompt service in Hawaii.

Is it possible to get more quality control on contracts in Hawaii without travel logistics interfering? It should probably start with this office (myself) in better and more frequent coordination.

JAMES CAMPBELL NWR

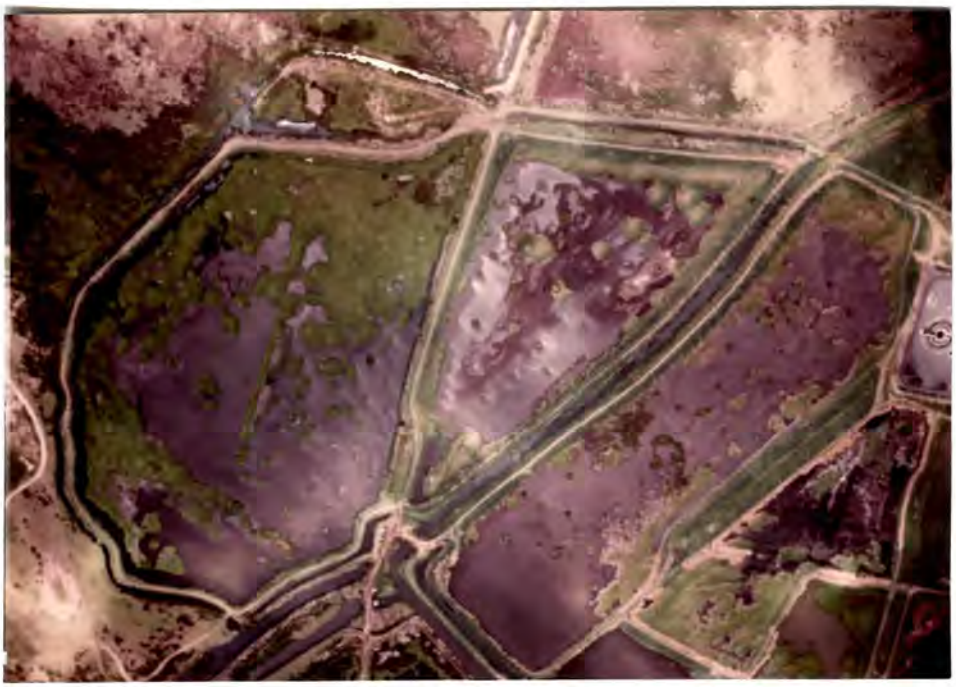
ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

The James Campbell National Wildlife Refuge consists of 145 acres of wetland habitat in two units near the community of Kahuku on the northeastern shore of Oahu, Hawaii. The Punamano Pond unit (37.5 acres) is a naturally occurring, spring-fed marsh, while the Kii unit (107.5 acres) consists of man-made ponds established in 1977 to provide habitat for Hawaii's four endemic, endangered waterbirds (stilt, coot, moorhen, Hawaiian duck) and other native wildlife, as well as migratory waterfowl and shorebirds. Prior to Refuge establishment, closure of the Kahuku Sugar Mill resulted in drying of the Kii settling ponds which had been used extensively by water birds. The James Campbell NWR was established in an attempt to enhance this wetland area and to provide maximum production and survival of endangered Hawaiian waterbird populations. The Refuge is managed by the FWS under a 55-year lease from the James Campbell Estate. One special condition of the lease states that the refuge must maintain major drainage ditches and a 40 hp. electric pump for flood control.



Kii Unit of James Campbell Refuge consists of moist-soil impoundments converted from settling ponds used previously by the Kahuku sugar mill. Manipulation of water specifically for waterbird habitat provides good production and maintenance habitat. (SB)

JAMES CAMPBELL NATIONAL WILDLIFE REFUGE

F. HABITAT MANAGEMENT

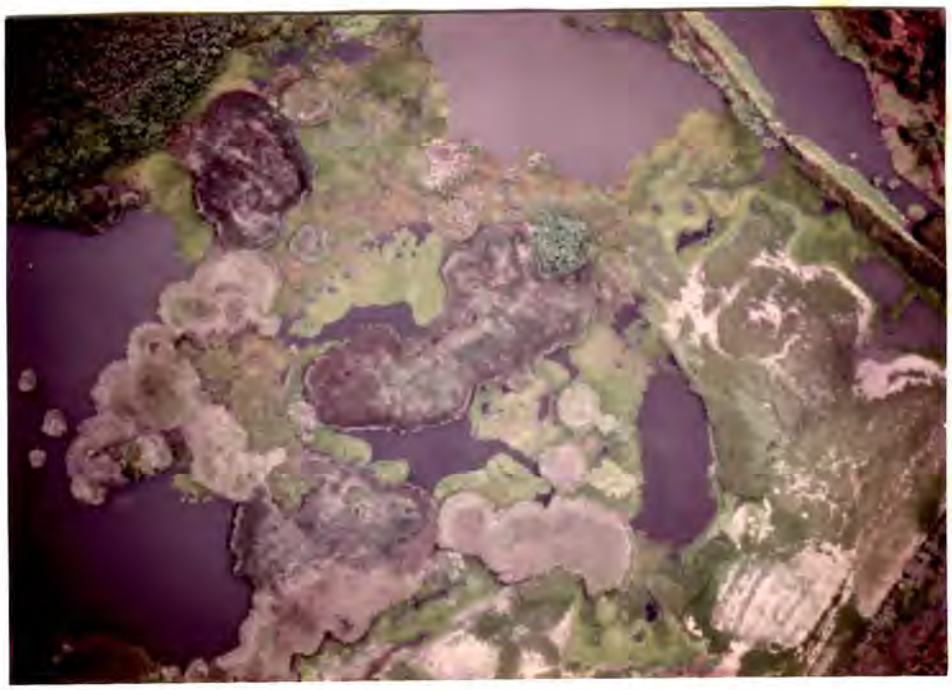
G. WILDLIFE

H. PUBLIC USE

H. PUBLIC USE (Cont.)

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS



Punamano Unit is a low-lying spring-fed marsh that is gradually being filled by sediment and vegetation. The permanent water condition makes rehabilitation of the marsh a major challenge.

A. HIGHLIGHTS

The University of Missouri completed the second and final year of its intensive field study of endangered waterbirds and wetlands. Insight on many aspects of wetland management were provided through biological data collection and monitoring (Sec. D.5). A bumper crop of approximately 45 stilts was fledged from James Campbell Refuge, primarily as a result of intensive, experimental management and water level manipulation from the University of Missouri study (Sec. G.2). An adjacent aquafarm converted from freshwater culture to brackish culture. Effluent from the farm flows through the ditch that waters James Campbell ponds resulting in elevated salt levels on the refuge (Sec. F.1). Other proposed encroachment by developers included a brackish shrimp farm on the southeast side of Kii Unit, and an industrial park and agricultural park in the watershed . There was concern that water quality would deteriorate rapidly with intensive commercial encroachment proposed (Sec. F.1). Public use at James Campbell was restricted to group visits with refuge staff or a docent leading the tour, but there were many requests for visits in 1986 showing a need for improved public use facilities (Sec. H.1). Both windmills on Kii Unit were serviced this year requiring a crane and operator (Sec. I.2). An experimental toxic bait was developed for mongoose control by cooperating research biologists, and plans have been made to conduct efficacy trials on James Campbell in the near future (Sec. J.3). Contaminant sampling was conducted at both units of James Campbell

NWR to determine levels of contaminants in fish, and black-crowned night herons; this sampling will provide insight into potential contaminant levels in endangered waterbirds and their environment as well as provide baseline data for future comparison (Sec. D.5).

B. CLIMATIC CONDITIONS

The nearest weather recording station, Amorient Aquafarm, is adjacent to the refuge. The following station summary for January-December, 1986, reflects the climatic conditions at the refuge, excepting rainfall data that was unavailable for November and December and temperature data that was unavailable for September and October.

	ave TEMP (MAX)	ave TEMP (MIN)	PRECIP (inches)
January	77.5	64.0	0.68
February	79.1	62.7	4.01
March	79.2	67.4	2.64
April	78.1	69.8	3.22
May	81.2	70.9	1.26
June	82.0	72.9	0.95
July	82.9	73.6	3.63
August	84.3	73.2	1.27
September	miss	miss	10.24
October	miss	miss	8.39
November	80.7	70.1	miss
December	78.4	68.3	miss

Typical weather patterns occurred in 1986: northeasterly trade winds averaging 12-14 mph blew through most of the year; kona weather occurred periodically through fall, winter and spring months resulting in reduced winds from the south and prolonged periods of wet weather.

C. LAND ACQUISITION

3. Other

A 12 acre addition to the existing leased parcel of James Campbell NWR was surveyed with monuments installed to mark the boundaries. The work was contracted by R.M. Towill, and completed in January. Completed maps of the surveyed area were delivered to the Honolulu office in March.

Kuilima Development Corp. continued plans for developing part of Punahoolapa Marsh as an endangered waterbird production area. The development of Punahoolapa Marsh as wildlife habitat and an interpretive facility is a requirement of the developer as part of their City and County permit for expansion of the resort complex in the area. Meetings with refuge and ES staff were held to discuss pond design, public visitation facilities, and potential for incorporating this area into James Campbell Refuge as additional waterbird habitat.

D. PLANNING

1. Master Plan

A Draft Master Plan for the Hawaiian Wetlands National Wildlife Refuge Complex was submitted for Regional Office review in 1985, and some minor editorial changes were submitted in 1986. The Regional Office had a few questions and concerns that were addressed, but their review was not completed in 1986.

3. Public Participation

The possibility of training an unemployed individual from Kahuku to work as an assistant maintenance person through the North Shore Career Training program was investigated. However, the program required that the employee would be permanently hired following an initial training period of one year funded through Campbell Estate. These conditions could not be guaranteed, so no agreement was arranged.

A meeting with the Adopt-A-Refuge chairman for the Audubon Society in December was instrumental in arranging plans for public use facility assistance at James Campbell NWR.

5. Research and Investigations

Black-crowned night heron study

A biological study of black-crowned night herons was conducted by Service staff during the latter part of 1985 and early 1986. Food habits data was collected from herons using Amorient Aquafarm adjacent to Kii Unit of James Campbell NWR. Other aspects of the study focused on population biology of herons, and exclusion devices to minimize predation of aquaculture reared crops.

Results of the food habits study did not document predation of endangered waterbird predation by herons, but specimens were collected on the prawn farm with little access to young waterbirds. A significant proportion of the population was subadult suggesting a rapid recruitment rate, and the total population was in excess of 700 birds for the Kahuku area. This population had exploded since establishment of the aquaculture industry from approximately 20 birds to a conservative estimate of over 700. Unfortunately no exclusion devices were developed to prevent herons from thriving on prawns, but a permit to take 200 herons was issued in 1986 to Amorient Aquafarm.

Removal of the 200 herons made a noticeable effect on the population, but it did not prevent feeding or recruitment. The night herons have been documented to prey on young waterbirds, and present numbers could have significant impacts on waterbird production. If populations are not controlled at a much lower level, or if their primary food source is not restricted, the heron population is expected to continue increasing with impacts to endangered waterbirds as well as aquaculture.

James Campbell NR85 - "Management and Selection of Endangered Waterbirds n Hawaii" (USDI 14-16-0009-1509)

Contractor: University of Missouri-Columbia, Cooperative Wildlife Research Unit

Investigators: Dr. Curtice R. Griffin
Dr. Leigh H. Fredrickson
Mr. Ken Neithammer

Collaborators: Stewart I. Fefer, Refuge Biologist
Jim Krakowski, Refuge Manager (Wetlands)
Steve Berendzen, Refuge Manager (Wetlands)
Hawaiian/Pacific Islands NWR

Objectives:
1. Develop moist-soil management techniques to optimize nesting and maintenance habitat for endangered waterbirds on NWR wetlands in Hawaii.

2. Monitor the vegetation and invertebrate phenologies and nesting of endangered waterbirds at James Campbell NWR.

3. Determine the seasonal phenology of waterbird usage of selected wetland habitats on Oahu.

4. Determine foraging patterns and activity budgets of waterbirds in different wetland types.

Period of Study: The project commenced on January 1, 1985, and field studies were completed in late December 1986. The final report with management recommendations is due to be completed in 1987.

The wetland national wildlife refuges in Hawaii were established to preserve and enhance habitat for Hawaii's four endangered waterbirds (stilt, coot, moorhen, koloa). Survival of these endemic waterbirds depends on a multi-faceted approach that will maximize their production and survival. At the core of a long-term conservation program is the need to secure, maintain, and enhance suitable habitat. Understanding the role of each wetland type within the annual cycle will enhance management efforts. Effective habitat enhancement programs become more important as Hawaii's unprotected wetlands continue to diminish in extent and quality. Financial constraints and increasing land use competition make it imperative that Hawaii's wetland managers become more aware of critical habitats and management options, and learn how to optimize the usage and quality of available wetland.

All four objectives were addressed by investigations conducted on the James Campbell NWR. The first two objectives were exclusively addressed on the Kii Unit of this refuge.

1986 Progress:

Baseline data collection was continued on endangered waterbird nesting biology, wetland plant phenology and biology, invertebrate associations with various plant species and water chemistry parameters, and moist soil management. Waterbird activity data was collected from various wetland types to assess specific use of plant and invertebrate materials from direct observation. More details on each of these areas are presented below.

WATERBIRD NESTING BIOLOGY

Systematic sampling of waterbird nest sites on the Kii Unit was conducted every 3 weeks. Approximately 150 nests of 5 waterbird species were found in 1986. Predation was the major factor causing nest loss; mongoose, dog and black-crowned night herons appeared to cause the most loss, in that order.

Intentional drawdown of ponds B,C and F for stilt nesting season resulted in a synchronous nesting period by the stilts. Manipulation of water levels to dewater ponds, and concentrate invertebrates and fish in puddles helped make a lot of food available for young stilt as they were growing. Slight changes in pond water levels resulted in various amounts of mudflat habitat, and provided dynamic fish and invertebrate populations. The results were obvious with at least 40 stilt fledged from Kii Unit and 70 fledged from Kii Unit combined with adjacent Amorient Aquafarm. The fledging success was incredible compared with the 2 or 3 stilt fledged the previous year.

Mudflat habitat and concentration of invertebrates and fishes in shallow areas provided good brood habitat for stilt chicks, allowing excellent recruitment of young into the Kahuku population. (SB)

WETLAND PLANT PHENOLOGY, BIOLOGY AND CONTROL

Monthly sampling of vegetation was conducted on the Kii Unit to document growth of dominant plant species (makai, California grass, knottweed, pickleweed, bulrush, barnyard grass, water hyssop, pluchea, and sea purslane). Phenology of plant growth periods, flowering, seed senescence, and dormancy or death were monitored monthly. Cover mapping of individual ponds was used to monitor gross changes in plant species distribution and abundance. Aerial photographs provided current information in species composition, and expansion or reduction of perennial vegetation.

Vegetation and water manipulations were made in all ponds at the Kii Unit to develop methods to control undesirable vegetation, and enhance growth of desirable plant species. Mechanical means were used to thin vegetation or release seed from clumped monotypic vegetation.

It was confirmed that California Grass provided little obvious benefit to endangered waterbirds, and was a constant nuisance due to its rapid expansion by rhizome into open water areas. Large patches of California Grass were removed from ponds B,C,F and G by herbicide application, and burning after the plants had died.

Pickleweed, previously thought to be a nuisance plant species, was found to produce tremendous quantities of seeds that were readily eaten by ducks and coots. However, the large monotypic expanses of this perennial emergent plant prevented access by the birds to seeds inside the large patches. Some experimental mowing was done in pond A prior to the winter rains to release seed and shorten the vegetation height so open water would be present after flooding. Ducks used these openings and apparently ate the seeds, and flooding killed portions of the mowed pickleweed resulting in openings interspersed throughout the monotypic expanse.

Some open areas of ponds C and F were disced for invertebrate sampling purposes to compare densities with undisced areas, and water hyssop was disced to break up large clumps and reduce expansion. It was feared that discing of water hyssop might result in sprouting of cuttings in other areas (as happens with knottgrass), but this did not happen.

Seed of millet and makai, that had been collected from ponds F and G during winter, was broadcast by hand on mudflats in ponds C and F in summer. Dense stands of these 2 plant species germinated and grew through the summer providing seed and cover into the winter months.

Water regulation and manipulation was utilized for flooding undesirable plants at critical times, allowing germination of annual plant seeds, and enhancing the growth of new vgetation.

Annual vegetation such as millet provide seed and browse for waterbirds and release nutrients for invertebrates during decomposition. Millet will germinate on mudflat areas while they are dewatered for stilt brood habitat. (SB)

INVERTEBRATE ASSOCIATIONS

Monthly sweep and core samples were taken to monitor changes in necktonic and benthic aquatic invertebrate populations in seven plant zones (makai, California grass, knottweed, pickleweed, bulrush, barnyard grass, and water hyssop) and in bare, open water areas in different ponds at the Kii Unit. Preliminary analyses indicated large differences in numbers of invertebrate families and total invertebrates between plant zones. For benthic invertebrates, water hyssop had the highest number of invertebrate families and the highest number of total invertebrates per sample. For necktonic invertebrates, knottweed had both the highest number of invertebrate families and total invertebrates per sample. The lowest numbers of invertebrates were found in California grass.

Knottgrass is a perennial grass that tolerates extreme water conditions, and provides waterbird browse, nesting habitat, and cover, and it also harbors high numbers of invertebrates. (SB)

WATER CHEMISTRY

Water chemistry consisted of monthly samples from each of the ponds at Kii Unit. Salinity, alkalinity, conductivity, and pH were determined for each sample.

WATERBIRD ACTIVITY MONITORING

Weekly activity budget information was gathered throughout 1986 in various wetlands on Oahu. Extended observation bouts up to one hour in duration were conducted to observe activities of individuals of all 4 waterbird species on James Campbell Refuge in addition to other Oahu wetlands.

Data were relatively easy to collect on stilts and coots; however, the secretive habits of the sparsely distributed moorhen made it difficult to obtain data as did the lethargic habits of the Hawaiian ducks that spent a disproportionately small amount of time feeding. Invertebrate sampling was randomly done in association with activity data collection; benthic and nektonic samples were taken from areas where birds had been observed for a period of time, especially if they had been feeding extensively. These comparisons of invertebrate abundance could only be correlated with feeding through "guilt by association", except in a few instances where the food items could be identified by observation.

Stilts were frequently observed feeding on fish, occasionally on crayfish, and would often sweep or probe the water and mud for smaller invertebrates. Coots fed on many plant species, apparently not being too selective except for algae that quite often had Lymnaeid snails in it. Coots also apparently pecked at insects on emergent stems early in the morning, presumably before the recently metamorphosed insects dried and departed. Moorhens were difficult to observe feeding, but most food items apparently consisted of vegetable matter, frequently associated with pickleweed. Hawaiian ducks dabbled in vegetation and shallow water; considerable evidence of them feeding on millet and makai seeds was also observed.

It was found that spending 1/4 to 1/2 hour intensively watching one impoundment or portion of a wetland allowed an observer to see nearly all waterbirds using that specific site, even the secretive moorhen.

Shallow water and mudflats provide excellent habitat for foraging stilt. Migrant shorebirds also use this habitat, and manipulation of water levels with production of annual plants can provide nutrient cycling for the production of favored food items. (SB)

REFUGE CONTAMINANT SAMPLING

Fish and black-crowned night herons were collected from James Campbell NWR for contaminant sampling in 1986. Kii Unit was used as a settling pond for Kahuku Sugar Mill prior to establishment as a Refuge in 1977. The watershed also has a diversity of agricultural crops grown with the use of pesticides and other chemicals. Fish and black-crowned night herons were collected in 1986 to provide insight into contaminant levels in these wetland ecosystems. Twenty composite samples of 2 livers each from the herons and composite samples of Tilapia sp. and mollies from each refuge unit will be analyzed for heavy metals and organochlorines. Other Hawaiian wetlands and Refuges were sampled as controls and for comparison.

6. Other

Representatives from Wilson Okamoto and Associates consulting firm visited James Campbell Refuge in August to see the pond layout and design on a nearly-developed refuge. This consulting firm s planning the project construction for ponds and water delivery systems at Huleia NWR and the proposed Kealia Pond acquisition.

E. ADMINISTRATION

1. Personnel

Refuge Manager Krakowski served a temporary assignment at Johnston Atoll NWR during much of the summer in 1986. Upon his return, Krakowski served as Special Projects Assistant to the Refuge Complex Manager. Refuge Manager Berendzen assumed responsibilities of all wetland refuges during Krakowski's absence, and permanently assumed these responsibilities in fall of 1986.

Tim Ohashi, a Refuge Biologist performed many duties assisting the wetland refuges as well as working on remote islands biological concerns. Tim assisted with collection of fish and black-crowned night herons for contaminant monitoring, he collected wetland biological data and assisted with other miscellaneous wetland projects.

David Woodside, Maintenanceworker WG-6 continues to be responsible for the maintenance of windmills, pumps, equipment, roads, vegetation, and predators on James Campbell NWR as well as Pearl Harbor and Kakahaia NWR's.

2. Youth Programs

Four YCC enrollees and a group leader participated in an eight week non-residential camp during the summer. Their activities on the James Campbell NWR included: construction of a storage room extension to the existing tractor shed, clearing vegetation from fencelines, repairing fences, trapping predators including mongooses and cats, painting tractors and implements, assisting the University of Missouri researchers with field data collection, and replacing refuge boundary signs. Many important projects were completed, and crew leader Greg Domingo can be commended for his fine job of supervision.

4. Volunteer Program

On March 15 several volunteers from the Hawaii chapter of the Audubon Society spent the day clearing nesting islands of vegetation at the Kii Unit. A total of 12 islands were cleared to provide stilt nesting habitat that would be needed in the following months.

Students from Leilehua High School and three supervisors visited Kii Unit on October 12. The group was given a tour of the wetland area, and they also performed volunteer work clearing vegetation and constructing small stilt nesting islands.

Volunteers provided assistance with vegetation removal and transplanting, and they were also given a tour of the Refuge with an interpretive and historical perspective of the Refuge's development. (SB)

The Hawaii chapter of the Audubon Society formally adopted James Campbell Refuge through the Adopt-A-Refuge program in 1985. They have provided active assistance through docent volunteers that lead tours of various groups on the refuge throughout the year. The Audubon Society intends to assist with development of interpretive signs and brochures for refuge visitor use.

This program has been a great asset to the refuge, by reducing staff workload and increasing public awareness of refuge programs and endangered species.

5. Funding

The Wetland Refuges budget is allocated by the Hawaiian Islands Complex Manager. The FY 86 budget for the wetland refuges was split between the 5 refuges on Oahu, Kauai and Molokai.

Funding spent on the endangered waterbird study benefitted all wetlands in the state, but most of the work was conducted at James Campbell NWR. Other projects included contaminant sampling, maintenance of pumps and windmills, and fence construction at Punamano Unit.

6. Safety

Refuge staff and YCC enrollees completed a course in first aid, and some individuals participated in a CPR course provided through the Service. Both training exercises were performed in early summer, prior to the busiest field season.

7. Technical Assistance

Kenneth Niethammer was assisted by Vanya DeYoung in early March through the duration of field data collection for the endangered waterbird study. Vanya was hired through the funding provided to the University of Missouri for this study.

Bill Striplin (RO-EN) visited the Kii Unit on March 14. He inspected FY 85 construction projects and discussed future work to be accomplished on this refuge.

On July 18, members of the University of Missouri endangered waterbird research team presented preliminary results and discussed the focus for the remainder of the study with refuge staff. Some accomplishments noted for James Campbell NWR were removal of monotypic expanses of vegetation from various ponds and an increase in Hawaiian stilt recruitment for 1986, in addition to findings of invertebrate responses to nutrient cycling within the ponds. Fieldwork for the endangered waterbird study was completed in December.

Refuge staff participated in semi-annual statewide waterbird surveys, and assisted other various agencies with resource related concerns or problems. National Marine Fisheries Service was assisted by monitoring turtle nesting on the beach adjacent to James Campbell NWR. Kaneohe Marine Corps Air Station was given suggestions and assistance regarding development plans for Nuupia Ponds wildlife area. The FWS Ecological Services office frequently asked advice regarding review of Environmental Impact Statements and Environmental Assessments pertaining to wetlands, waterbirds or any wetland mitigation projects. Refuge staff were also involved in proposed planning of projects that may impact existing Refuges, such as aquaculture facilities, an industrial park, and hydro-electric power facilities.

F. HABITAT MANAGEMENT

1. General

This 145 acre refuge consists of approximately 113 acres of wetlands, 5 acres of grasslands, and 27 acres of scrub forest areas.

The Kii unit consists of a series of seven diked ponds (A-G) in which water levels are controlled by electric and wind-driven pumps. Water control structures in the form of concrete or metal culverts and flash board risers connect each pond. Small nesting islands were constructed within each pond. Dominant vegetation includes: Batis maritima, Brachiaria mutica, Pluchea indica, Scirpus spp., Echinochloa crus-galli, and Bacopa monnieri.

The Punamano unit is a natural system. It is a spring-fed pond with deeper water areas. This unit contains more emergent plant growth than the Kii unit. Its wetland area is dominated by Scirpus spp. along with Typha sp. Bacopa monnieri, and Pluchea indica.

The 107.5-acre Kii unit is surrounded by a livestock fence, while the 37.5-acre Punamano unit remains unfenced, excepting a small portion completed in early 1986 by Refuge staff.

Saltwater Effluent From Aquaculture

Amorient Aquafarm, adjacent to Kii Unit of James Campbell NWR began converting aquaculture ponds from freshwater to saltwater in July, 1986. The company could not make profit on freshwater prawns so their option was to go out of business or convert to saltwater shrimp. Because of a much shorter growth cycle and greater demand, the saltwater shrimp business appears to be more profitable. However, impacts of saltwater effluent on James Campbell refuge are very harmful as effluent passes through the refuge and is pumped into ponds.

Refuge staff monitored salinities of effluent passing through the refuge and entering moist soil impoundments throughout the period saltwater was being discharged. The Hawaii Health Department was contacted as the regulatory agency for effluent disposal, but no regulations prevented discharge into a man-made ditch under operation as Amorient was being conducted.

Perceived and anticipated problems were outlined to Campbell Estate and Amorient at meetings that were held regularly through fall and early winter months. Campbell Estate was supportive of the saltwater aquaculture because they did not want to lose the income provided by this lessee. Campbell Estate representatives suggested the refuge get water from the sugar mill wells as the lease agreement specified. Refuge personnel felt there would be conflicts with other users of these wells, and with adjacent lessees where a pipeline would have to pass through their lease area. Refuge staff responded with these concerns and suggested that a freshwater well be dug on refuge land to provide a secure source of fresh water.

By late December, Amorient and Campbell Estate agreed to assist the Refuge with acquisition and construction of a new windmill, construction of a new water delivery system and development of a new well for a freshwater source.

Campbell Estate had never intended for the FWS to use Punamano ditch as a water source for the refuge. When asked if water could be pumped from this ditch, Campbell Estate authorized this use in conjunction with responsibilities outlined in the lease agreement requiring evacuation of ditch waters for the benefit of other lessees. There were no apparent legal restrictions on Amorient's saltwater discharge, and an attempt by the refuge to cause regulations to be formulated would most likely alienate the aquaculture industry in Hawaii and Campbell Estate, as well as many state and county agencies. The duration of this optional process might also span 2 or more years with no confirmed benefit to the wetland habitat at James Campbell refuge.

Other potential impacts of restrictive regulations being formulated might result in Amorient going out of business. The resulting use of the land would most likely displace the endangered waterbirds using the aquafarm (approximately as many waterbirds use Amorient Aquafarm as there are using James Campbell NWR) resulting in the loss of extensive waterbird habitat.

Another water quality concern was the use of pesticides on a growing amount of acreage being farmed in the watershed of Punamano ditch. Well water from the basal aquifer would be free of contaminants that presumably flow into Punamano ditch and out to sea.

An additional source of concern was disclosed in October by Campbell Estate; they proposed the development of an industrial park in the watershed of Punamano ditch, adjacent to James Campbell NWR. Preliminary plans were discussed with Campbell Estate representatives, and refuge concerns were expressed. Campbell Estate was informed that plans must include mitigation for negative impacts anticipated by the refuge.

Another perceived threat to Kii Unit was the proposed construction of a saltwater aquafarm on the south and east sides by Bruce Smith of Kahuku Prawn Co. Smith provided rough plans of his proposed facility to the refuge in 1986 and conducted some percolation tests on the proposed lease area. Refuge personnel were concerned that saltwater would percolate from Smith's ponds into refuge ponds, thus polluting refuge habitat. Other fears included concern over a planned injection well that probably could not handle all of the discharged effluent. Excess effluent could potentially run onto refuge land and into Punamano ditch. This project would also impact the endangered species on the refuge due to disturbance from its proximity, and it would destroy habitat utilized by endangered waterbirds, shorebirds, the state endangered Hawaiian owl, and the threatened green sea turtle. The land area proposed for development is one of the most natural beach strand areas on Oahu, and is the only known site on the main Hawaiian Islands regularly visited by migrating bristle-thighed curlews.

The refuge will continue opposing the proposed project to preserve the integrity of James Campbell NWR.

The unique beach strand habitat bordering Kii Unit on the ocean side is becoming less common on the main Hawaiian Islands. Several temporary and part-time wildlife inhabitants such as this bristle-thighed curlew are threatened by the loss of this habitat. (SB)

2. Wetlands

Kii Unit:

Management within the Kii unit consisted of manipulating water levels within Ponds A,B,C,D,F and G by pumping water from the main drainage canals. A five-horse power electric pump along with two low-lift wind generated pumps moved water to the Ponds. One water delivery system is a 13.5" pump (Pump C) that is driven by a 12' windmill. The other system is an 18" pump (Pump D) that is driven by a 14' windmill. Ponds A and E were also flooded by backflowing water into them through drainage ditches; the water was evacuated by the 40 horsepower pump from Punamano ditch but was artificially restricted by flashboards in the concrete culvert. This elevated water levels in the ditches, resulting in backflow into ponds A and E through flapgates in the control structures.

High ditch levels were typically helpful throughout the fall and winter months when full or nearly full pond levels are preferable. However, problems were encountered with high surf during spring months when stilts began nesting. High surf would clog the evacuation ditch going out to sea and water would remain at higher levels in the ditch, hampering drawdown of ponds for stilt nesting. Running the 40 horsepower evacuation pump overnight would typically flush the sand plug in the ditch, and allow pond drainage.

Ponds B,C and F were dewatered to expose mudflat areas at the onset of stilt nesting season. This resulted in synchronous nesting by the stilts, and slight manipulations in water levels throughout the summer provided a lot of mudflat and shallow water habitat resulting in dynamic food supplies for young stilt.

Small stilt nesting islands were constructed in ponds B,C and F when they were drawn down by using a tractor and blade. Stilts appeared to prefer small earthen humps or mudflats for nesting in preference to large (greater than 20 square feet), elevated nesting islands.

Small humps or elevated portions of mudflat are preferred nesting sites by stilts; these birds most likely evolved to utilize the highest bare areas available at the end of the winter rains. (SB)

Punamano Unit:

Saltwater effluent from Amorient aquafarm flowed up the ditch to Punamano pond during periods of low rainfall. Apparently the effluent discharge from Amorient is great enough that it exceeds the flow from Punamano spring during low flow periods, resulting in saltwater contamination in Punamano pond. A flapgate was designed by maintenanceworker Woodside, and Campbell Estate said they would provide the materials if the Service would install the flapgate. This should be done soon to prevent additional flow of saltwater into Punamano. However, it may be interesting to experiment with various salinity levels in Punamano pond to monitor the effects on overgrown areas of giant bulrush and cattail. Saltwater over an extended period of time might thin or eliminate dense stands of vegetation that is overtaking the pond. Before an experiment of this sort could be conducted, an assessment of potential impacts on existing endangered waterbird usage should be conducted.

3. Forests

The Kii unit contains very little tree or shrub growth. The Punamano unit contains some upland areas that are densely covered by koa-haole (Leucaena glauca), kiawe (Prosopis pallida), and Pluchea spp.

9. Fire Management

Some small patches of California grass were removed from ponds B and C on Kii Unit in January by prescribed burn. Other small patches of grass were burned from ponds D, F and G in late summer after herbicide application.

Some sprouting of California grass root clumps occurred after burning, but immediate flooding with coverage of at least six weeks was adequate to kill the sprouted plants.

10. Pest Control

Vegetation control of Brachiaria sp. (California grass) on the Kii unit is an annual maintenance task. Spraying a 2% solution of Roundup on pond and ditch banks during summer when water levels are low produce the best results. California grass encroaches into ponds by rhizome growth, but this species can be controlled from the banks to prevent establishment within ponds or ditches.

The increased salinities in ponds on Kii Unit inhibited growth of California grass during the latter part of 1986.

Small areas of pickleweed were mowed in pond A in late fall to create openings in the monotypic expanse of pickleweed. This plant species is a pest only when it grows by rhizome to the extent where it becomes a monotypic expanse. This plant is a heavy seed producer and provides food and cover for waterbirds as well as nesting substrate. Invertebrate cover is also provided, but openings are necessary to allow access by waterbirds to the food sources provided.

Pickleweed provides an abundance of seed used by waterbirds in addition to nesting habitat, browse and invertebrate substrate. However, vegetative growth allows it to spread into monotypic expanses that exclude bird usage, so it must be controlled periodically to provide good interspersion with open water and other plant species. (SB)

Indian fleabane (Pluchea indica) is another plant pest that can dominate wetland areas if not controlled. However, this species is easily controlled by mowing and reflooding. Some scattered patches of fleabane provide cover for wetland inhabitants, and stilts apparently benefit from the protection it provides on especially windy days.

Another plant species that causes concern to wetland managers in Hawaii is water hyssop (Bacopa monnieri). This low-growing succulent grows in dense mats expanding by rhizome, and it floats on the water surface, varying with water levels. This plant can be controlled by discing in dry ponds if reflooding is delayed until after the plant stems have dessicated. In permanently wet areas that cannot be disced, a broadleaf herbicide such as Banvel is effective.

Cattail bulrush are also undesirable plant species that can rapidly overtake wetland areas. The constant growing season allows up to 6 growth cycles per year of some bulrush species. Cattail also produces vigorous new growth throughout the year, and the best control method in moist soil impoundments appears to be total exclusion. Herbicide and manual pulling of new sprouts are the most effective methods used for these 2 species on James Campbell refuge.

Experimentation with the above-mentioned techniques and species was conducted during 1986 on James Campbell NWR.

Other species considered pests on wetland refuges include cattle egrets and black-crowned night herons. Cattle egrets were introduced to Hawaii in an attempot to control agricultural pests, especially ectoparasites of livestock. Cattle egret populations have exploded on all main Hawaiian islands resulting in competition to many other bird species. Reflooding of ponds typically drives terrestrial invertebrates out of the vegetation. These invertevbrates could be a tremendous food source and protein supply, especially for koloa, coots and gallinules at the commencement of their breeding seasons. However, hundreds of egrets usually converge on ponds when they are being reflooded and the bulk of the invertebrates apparently feed cattle egrets and their young in the adjacent rookery. This problem was discussed with the local Animal Damage Control representative who is working on a solution.

The indigenous black-crowned night herons have artificially high populations in areas where aquaculture has enabled an increase in numbers and maintains these populations. Herons not only compete for food with endangered waterbirds, but they also feed on eggs and young of waterbird species. Counts of greater than 120 herons are frequently made on the Kii Unit, and a roost/rookery is located on Punamano Unit.

The indigenous black-crowned night heron adds diversity to Hawaiian wetlands, but aquaculture has allowed this species to increase in numbers to the point of being a nuisance to aquafarmers and a threat to endangered waterbird young. (SB)

G. WILDLIFE

1. Wildlife Diversity

Although the wetland management efforts made during this period were directed at improving the nesting and feeding habitats of the endangered waterbirds, numerous other migratory bird species used these same improved areas. The refuge is used by many migrating and wintering bird species.

2. Endangered and/or Threatened Species

All four endangered Hawaiian waterbirds (Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck) nest and maintain populations on both units of James Campbell NWR. Normally, the Kii unit contains higher numbers of these birds. Kii Unit was used more extensively for population assessment due to its accessibility and manageable moist soil impoundments.

Hawaiian Duck (koloa)

Hawaiian duck behavior and habitat use is not well understood. This species is very mobile and exhibits seasonal variation in use of James Campbell wetlands. Peak numbers occur during the winter months with nearly 100 koloa present on James Campbell refuge at times. Populations build up in late fall (typically coincides with pond reflooding) and nesting usually begins in December. Koloa intermix with wintering migrant ducks and apparently maintain themselves throughout late spring after the migrants have departed. The small percentage of nesting ducks remain on the refuge through mid-summer, some hens often producing up to 4 or 5 clutches per season. High brood mortality could account for multiple nesting attempts, but hatching success is typically in excess of 60%. The refuge is used throughout the summer by small numbers of ducks, usually 20 to 40, primarily at night, and presumably for roosting. The Hawaiian duck uses mountain stream habitat extensively on other islands it inhabits, and may depart for Oahu streams during the summer months.

It was estimated that approximately 12 pairs of koloa nesting on James Campbell refuge fledged approximately 20 young that were recruited into the population. Many duck broods moved back and forth between Kii Unit and the adjacent Amorient aquafarm.

Hawaiian Coot

Hawaiian coot numbers on James Campbell NWR fluctuated seasonally, but not to the same extent as the koloa. Winter numbers well in excess of 300 were observed with the summer low being around 240 birds. Coots readily move to other wetland areas when food sources are better; a large portion of the coot population appears to merely be maintaining itself and does not breed. Successful pairs of breeding coots require a territory that can be defended from coot competitors while also providing all nutrient

requirements for egg production and chick growth as well as adult maintenance. Most successful territories have a core area of permanent water with perennial plant species that provide cover and invertebrates, and dynamic peripheral areas that produce annual vegetation and periodic food abundances.

Coot territories are somewhat flexible, with some persisting throughout the year and others being seasonal. Approximately 25 territories resulted in a conservative recruitment estimate of approximately 30 coots. The majority of coot nests successfully hatch, but brood survival is low with limited food resources for chick growth being a suspected factor.

Hawaiian Moorhen

Unlike the Hawaiian coot, the moorhen appears to be strictly territorial and does not have large "floating" populations of nonbreeding birds. Most all areas of potential habitat appear to have a pair of moorhen occupying a territory. They do not tolerate other conspecifics inside their territory and presumably chase off their young shortly after fledging. Moorhen territories seem to be more flexible than those of breeding coots, and they fluctuate somewhat in size depending on water conditions. The number of territories appears to be somewhat stable with an estimated 40+ pairs on James Campbell refuge. Nesting typically occurs from December through July, but in permanent water areas some pairs nest throughout the year: very similar to paired coots. It was estimated that approximately 55 moorhen young were fledged in 1986, but it is not known if any habitat was available for them to be recruited into. Moorhen nesting and fledging success seems to be better than that of the koloa or coot, possibly due to their habit of foraging in more terrestrial habitat where a greater abundance and diversity of food might be available for young.

Hawaiian Stilt

The Hawaiian stilt is a mobile species that utilizes dynamic food sources as they become available, especially on the adjacent aquafarm when ponds are dewatered for shrimp or prawn harvest. Manipulation of refuge ponds also creates concentrations of available food through reflooding of densely vegetated areas, drawdown of ponds to concentrate fish and invertebrates, and decomposition of annual plant material that results in tremendous invertebrate hatches.

The stilts utilizing the James Campbell / Amorient complex should be considered one population. Prior to breeding season the population numbered slightly over 100 birds; after recruitment of fledged young into the population it was greater than 170. Of the 70+ stilt fledged, over 40 of them were produced on Kii Unit. Many ponds on adjacent Amorient aquafarm were partially dewatered for conversion to saltwater resulting in excellent stilt breeding habitat.

Manipulation of moist soil impoundments for stilt nesting works very well for production of annual plant species such as millet and makai. A slight drawdown at the onset of stilt breeding season (usually March through May) provides small humps of mudflat or nesting islands that birds will nest on. Gradual drawdown should provide mudflat and shallow water areas for

the earliest hatching stilt chicks, and additional drawdown provides formation of puddles where small fish and invertebrates are concentrated. Minor fluctuations of water levels result in hatches of additional Gambusia and Tilapia providing a good food source as long as fish brood stock are maintained in the ponds. The summer drawdown also allows germination of the annual plant species in whatever areas are dewatered if a good seedbed is present. The annual vegetation should be maturing in late fall when ponds are reflooded and migrant waterfowl return to Hawaii. The annuals provide a food source for these birds and provide subrate and nutrients for invertebrate hatches as they decompose throughout the winter.

Green Sea Turtle

The only documented site of green sea turtle (Chelonia mydas) nesting on Oahu is located on the beach just outside the refuge. Refuge staff monitored the beach weekly through the summer and one nest was located. After hatching, biologists dug up the nest and discovered that nearly all of the 70+ eggs hatched. The green sea turtle is a threatened species.

3. Waterfowl

Wintering, migratory waterfowl use the refuge from September through May. The most abundant species were shoveler and pintail with maximum numbers totalling 235 and 90, respectively in December. There were more migrant waterfowl using James Campbell NWR in the latter months of 1986 than were using the refuge the previous winter season. This may have been due to greater production of annual plants for food in combination with more water level manipulation.

Other regular migrants include a mix of lesser and greater scaup (approx. 20 total), a few green-winged teal, approximately 10 american wigeon, a few eurasian wigeon, and an occasional garganey teal or ring-necked duck.

The bulk of the dabblers spend most of their time in the moist soil impoundments at Kii Unit, especially in the 20 acre pond A that apparently affords protection from occasional disturbance on surrounding dikes. Most of the diving or bay ducks stay at Punamano Unit where a larger, deep open water area provides secure habitat.

A small population of scaup continues returning to Hawaii annually. The loss of wetland habitat has affected populations of migrant waterfowl as well as endangered waterbird species.

The resident population of fulvous whistling ducks remained stable at approximately 30+ birds. Several nests of this species were found on James Campbell refuge again this year; hatching success was very poor, but clutches that hatched were typically large and brood survival was excellent. However the recruitment was not obvious in this small population so unexplained mortality or emigration must be limiting the growth of this population.

4. Marsh and Waterbirds

Kii Unit:

The black-crowned night heron population was variable with over 140 birds observed one evening, mostly at a pond being dewatered with lots of stranded fish. The night heron population in the Kahuku area is well in excess of 500 birds, and little is known about their feeding habits due to their crepuscular and nocturnal habits.

Frequently, herons are observed in areas adjacent to nesting coots and stilts. Several times during the year night herons were observed taking the young of endangered waterbirds. Control of these overabundant predators might be desirable; however, a more detailed study of their food habits might be appropriate before extensive control is initiated.

The heron food habits study conducted by Tim Ohashi while he was with the Service provided no evidence of heron predation on young waterbirds, but the study was conducted on neighboring Amorient Aquafarm where herons had almost no access to waterbird nestlings.

The cattle egret population is also variable, but an adjacent rookery/roost harbors up to several thousand egrets. At times when ponds are being reflooded, well in excess of 200 birds can be seen feeding in the flooded vegetation picking up displaced terrestrial invertebrates that otherwise would feed endangered waterbirds or recently arrived migrants. It is uncertain what additional impacts the cattle egrets may have on the endangered waterbirds; they could possibly act as predators or vectors of avian disease.

A great blue heron established residency at Kii Unit for a couple of weeks in April. Other sightings of individual great blue herons in Hawaii might be this same individual or others that are scattered around the different islands.

Punamano Unit:

A black-crowned night heron roost/ rookery is located in a large clump of trees in the center of Punamano Unit. Numbers typically average about 30 birds and the impact on endangered waterbirds on the wetland ecosystem is unknown.

Cattle egrets frequently feed at Punamano Unit, presumably competing with waterbirds. It is interesting to note that many of the cattle egrets have apparently adapted to wading in shallow water and they feed on nearly any critter they can swallow. This may be a learned behavior from birds at various aquafarms where egrets frequently wade into ponds that are being dewatered for harvest of various aquatic animal species.

5. Shorebirds, Gulls, Terns, and Allied Species

The refuge is one of the better shorebird habitats in the state and several species may be seen during the fall, winter and spring months. Habitat manipulations designed for the stilt at the Kii Unit were equally attractive to most migratory shorebirds.

Kii Unit:

American golden plover and ruddy turnstones were the most abundant species, numbering up to 300 and 200 birds respectively, during the fall migration. Sanderlings and wandering tattlers were also common with peak populations of 66 and 22 respectively, during fall migration. Other incidental shorebirds observed in 1986 included: 8 long-billed dowitchers, 1 semipalmated plover and 3 ring-billed gulls.

Punamano Unit:

Punamano unit has only seasonal shorebird habitat resulting from inundation of mudflats due to heavy rains. American golden plovers, ruddy turnstones, sanderlings and wandering tattlers are all seen in small numbers (less than 20) during migration.

6. Raptors

Short-eared owls (Pue'o) were frequently observed hunting over the grassy areas of the Kii unit, or flying over portions of marsh at the Punamano Unit. The Pue'o probably nests on the refuge, although no nests were actually located.

The Hawaiian short-eared owl or pue'o is the only indigenous raptor occurring on Oahu wetlands. This species is found on both units of James Campbell NWR. (SB)

Occasional observations of a barn owl were made on the Kii Unit. This species was introduced to prey on rats and mice in sugar cane to hopefully decrease the impacts of the rodents on the sugar cane production.

An osprey was occasionally seen fishing over ponds at both refuge units. This accidental visitor has no obvious impact on the waterbirds and is very esthetic to see on the refuge.

7. Other Migratory Birds

Laysan albatrosses were regular visitors on the dunes outside of Kii Unit during the winter months. Great frigatebirds would occasionally drink fresh water from Kii ponds by swooping low over them. One brown booby was observed resting on the pumphouse at Kii Unit during the winter.

10. Other Resident Wildlife

Approximately 20 to 30 ring-necked pheasants reside on the refuge. In the past, local hunters have crossed refuge boundaries in search of these birds. No observed pheasant hunting or related trespass violations occurred in 1986.

15. Animal Control

Live traps were set prior to the 2 nesting peaks of the endangered waterbirds during 1986 to catch mongooses, dogs, and cats. More mongooses were caught during the early winter trapping session when the bulk of the coot, moorhen and koloa nesting began than during the spring session prior to stilt nesting season. The mongoose is a prolific animal that is quite an efficient predator of waterbirds and their young. The trapping program is designed to minimize predation on nests and young.

A total of 310 trap nights captured approximately 85 mongoose, 7 cats, and 3 rats on the 2 refuge units.

The mongoose is an opportunistic diurnal predator introduced to Hawaii for rat control. However, the mongoose eats nearly anything it encounters including waterbird young and eggs. The healthy appetite of the mongoose is also a fault: they are easily trapped but so numerous that others quickly replace them. (SB)

Lethal control of black-crowned night herons on adjacent Amorient Aquafarm was conducted during the latter part of 1986 to reduce predation on aquaculture crops. This control had mixed impacts on James Campbell Refuge; heron numbers increased on the refuge as a result of being disturbed from Amorient, but the total population in the Kahuku area was reduced, hopefully resulting in fewer birds preying on wetland species in the future.

H. PUBLIC USE

1. General

The Kii unit of James Campbell NWR has been designated by the Refuge Complex as the refuge interpretation and education site for the island of Oahu. It is the largest unit, and occasional public use of one portion of the unit results in minimal disturbance to the waterbirds.

Public use of James Campbell NWR during 1985 was limited to specific requests by school groups, scout clubs, local bird groups or individuals interested in visiting the refuge for educational purposes such as photographic documentation or visual observation. The refuge was visited by approximately 15 groups consisting of nearly 450 people during the year; many of the group tours were led by Audubon Society docents.

Public use of Kii Unit is limited, primarily due to the lack of restroom facilities, lack of interpretive displays, and the refuge's distant location on the north shore of Oahu, in addition to the lack of part-time personnel or volunteer staff needed to monitor and maintain proposed public use facilities.

Small groups of individuals from various agencies, organizations or professional businesses visited James Campbell refuge during 1986. Some visits were for wetland design purposes while other visits were intended to enlighten individuals on certain aspects of the refuge or on mechanics of specific facilities.

2. Outdoor Classrooms - Students

The refuge was visited by 9 groups containing approximately 260 students during the year. Refuge staff and Audubon Society docents conducted the tours. Most school groups visit during the late fall and winter months when many migrant birds are present to observe, most ponds are full, and stilt are not yet nesting when disturbance could impact them.

The docent program helps secure the refuge's environmental education objectives for the Kii unit. Docents attempt to encourage the use of the refuge as a classroom. Ecological studies involving the animals, plants, invertebrates, water chemistry, etc. are promoted.

6. Interpretive Exhibits/Demonstrations

Some minor changes to the public use facility plans were implemented during 1986, with hopes that a modified plan could be funded in 1987 to allow a broader range of public use with more exposure to the refuge resources.

11. Wildlife Observation

Five birding groups toured the Kii unit of the refuge during 1986, and all of the school groups that visited were intent on observing the wetlands and its unique inhabitants.

17. Law Enforcement

An occasional weekend problem is the trespass of fishermen on the Kii unit. Most times they are attempting to catch baitfish at the outlet structure. Those apprehended were advised of the refuge objectives and the rationale for not allowing trespass on the refuge. No citations were issued.

I. EQUIPMENT AND FACILITIES

1. New Construction

An enclosed addition to the tractor shed was constructed during the summer by force account with the assistance of the YCC crew. The tractor shed is relatively small with 3 small bays protected on 3 sides for 2 tractors and a trailer mounted sprayer and pump. The new enclosed addition supplements a much smaller enclosed area and will provide storage area for herbicide, fire equipment, hand tools and other miscellaneous parts and items. This tractor shed is located on the adjacent Amorient aquafarm where better security is provided.

2. Rehabilitation

The 2 windmills at the Kii Unit were in bad need of repairs in early 1986. A mobile crane and operator was rented in January to pull the heads of both windmills. The 14-foot windmill had roller bearings replaced under the head to allow better movement, and the 12-foot windmill had a new mill installed since the old blades were rusting to the extent they were falling off.

The pump from the 14-foot windmill was removed in late January to be reconstructed and strengthened; repairs were completed and the pump was replaced in March. During the interim when the pump was not working, water levels were maintained in ponds C, D, F and G by use of the electric 5 horsepower pump

Additional repairs were made on the 12-foot windmill and pump in June.

On the north shore of Oahu, reliable winds can provide water throughout the year with a variable stroke windmill that pumps volumes according to the wind speed. (SB)

4. Equipment Utilization and Replacement

The old one ton army ambulance that was used to transport the YCC crews and to tow tractors between refuges was given up as surplus and a 1 1/4 ton army truck was obtained from military surplus to replace it. The old ambulance had temperamental brakes and was difficult to maneuver; hopefully the replacement vehicle will provide better service for towing and hauling heavy loads.

7. Energy Conservation

The windmills on Kii Unit working the Avery/Young pumps appear to be a good combination for pumping great volumes of water with only a low head. These windmills are prototypes and require frequent servicing and maintenance, but they have provided considerable savings in comparison to utility costs. The use of these windmills is also providing a service to the manufacturers who are experimenting with improved models.

J. OTHER ITEMS

3. Items of Interest

The endangered waterbird study provided needed answers to questions regarding freshwater wetland dynamics in Hawaii. Many interrelationships in the wetland ecosystem were not understood prior to the undertaking of this study; however, many of the answers seemed straightforward and simple once they were understood. The basic principles for wetland management on the mainland apply, but seasonal conditions amplify the problems caused by exotic vegetation.

Many findings from the waterbird research have been applied to management with rapid and obvious results. The insight provided by this study should be implemented into management plans, and hopefully publication of these results can provide this knowledge to others interested in managing or understanding dynamic wetlands in Hawaii.

Toxic bait for mongoose

A study to develop a toxic bait for mongoose in Hawaii is being conducted by Animal Damage Control personnel on the island of Hawaii. Jim Keith, the biologist in charge of this work visited James Campbell refuge to assess the feasibility of conducting an efficacy study on the refuge. The refuge hopes that James Campbell will be chosen as a study site in hopes of getting knowledge and expertise from the ADC staff. The mongoose is a destructive predator of endangered waterbirds and their nests. An effective toxicant would be very beneficial to reduce mongoose numbers on the refuge, especially prior to nesting season.

4. Credits

Steve Berendzen wrote this narrative.

K. FEEDBACK

The wetland refuge complex in Hawaii is developing a good understanding of wetland dynamics and the wetland ecosystem as it relates to endangered Hawaiian waterbirds, migrant shorebirds and migrant waterfowl. As with any study, each answer that is obtained raises two more questions. But by prioritizing the questions and approaching them with a scientific perspective, the answers can be obtained.

The endangered waterbird study provided considerable insight into freshwater wetland management in Hawaii, and management has made many improvements as a result of this study. It seems imperative to maintain the momentum established, and continue addressing priority questions including dynamics of brackish wetlands.

Hawaii has a diverse wetland background with few natural wetlands remaining. Unfortunately, human impacts have affected all remaining wetlands in Hawaii, especially through exotic vegetation introduction. Natural wetlands are diminishing in value to waterbirds, yet management techniques have been proven to effectively rehabilitate overgrown wetlands for waterbird habitat.

In order to provide secure manageable wetland complexes, more wetland habitat must be preserved and managed, including buffer areas around existing Refuges. Wetland areas must be large enough to provide all the needs for populations of endangered waterbirds and migrants. Too much energy is wasted when birds are forced to leave small areas in search of more permanent wetland habitat. Territory disruption also occurs to species that expend considerable energy defending territories in hopes of producing young.

Migrant ducks urgently need the benefit of wetland enhancement and preservation. Historically, Hawaii provided wintering habitat for tens of thousands of migrant waterfowl consisting of several species. These populations have dwindled to fewer than 1,000 birds, primarily of two species - northern shoveler and northern pintail. These species require an abundance of seeds and invertebrates during their winter visit to restore energy reserves. Without good quantities of nutrients, these ducks cannot form pair bonds and restore their health to produce young when they return to the breeding grounds. Secure, undisturbed winter habitat with good food availability is essential for these birds to maintain or increase their populations. It is the Services responsibility to enhance these populations that evolved to utilize Hawaiian wetlands and add so much diversity to the wetland ecosystem.

Actively managed wetlands can provide habitat for endangered Hawaiian waterbirds as well as migrants through ecosystem management. Wetland habitat does not have to be provided only from natural wetlands; marginal cropland with a good gravity flow water source could be converted into moist soil impoundments that would require much less maintenance and initial development costs than rehabilitation of existing natural wetlands.

These man-made wetlands might not replace other values provided by natural wetlands, but they would bring the Service closer to its objective of downlisting or delisting endangered waterbird species.

With Hawaiian wetlands diminishing at a rapid rate, opportunities for additional wetland acquisition must not be passed up.

PEARL HARBOR NWR

ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

The Pearl Harbor National Wildlife Refuge consists of 61 acres of man-made wetland habitat in two separate units on the south shore of Oahu, Hawaii. The Waiawa unit (24.5 acres) is located near the east shore of Middle Loch on the Pearl City Peninsula within the Pearl Harbor Naval Base. The Honouliuli unit (36.5 acres) is located along the west shore of West Loch within the Pearl Harbor Naval Base. The refuge was established in 1976 to provide habitat for three species of endangered Hawaiian waterbirds and other native wildlife that inhabit the wetland environment. Low dikes retain shallow water impoundments on each unit. Electric pumps provide water for each of the ponds. The Pearl Harbor refuge units were constructed to partially mitigate loss of natural habitat resulting from the construction of Honolulu International Airport's reef runway. The refuge is managed by the U.S. Fish and Wildlife Service under a Cooperative Agreement with the U.S. Navy.

The Honouliuli Unit of Pearl Harbor NWR consists of 4 ponds, but much of the area within the ponds is made up of large islands and huge levees separating the ponds. These ponds can be manipulated for moist-soil management, and hopefully pond improvements can be made to provide additional area for inundation. (RJS)

PEARL HARBOR NATIONAL WILDLIFE REFUGE

F. HABITAT MANAGEMENT

G. WILDLIFE

H. PUBLIC USE

H. PUBLIC USE (Cont.)

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

The Navy conducted some contaminant sampling at Waiawa Unit of Pearl Harbor refuge to assess contaminant levels suspected to be leaching from the above dump site (Sec. D.5). Meetings with Army representatives regarding reconstruction of Honouliuli Unit impoundments appear to have been productive. The Army hopes to use this task as a training effort for heavy equipment operators (Secs. D.6 & I.2). A more efficient pump was installed at Waiawa Unit to provide better water flow after the old pump quit working (Sec I.4).

B. CLIMATIC CONDITIONS

The nearest weather reporting station, the Honolulu Observation Station, is located approximately 3 miles south of the refuge. The following station summary for January-December, 1986, reflects the climatic conditions at the refuge:

	PRECIP	TEMP(ave max)	TEMP(ave min)
January	0.18	82.0	63.6
February	1.38	82.4	62.7
March	0.17	84.5	68.5
April	0.35	84.3	70.7
May	0.81	86.2	70.3
June	0.36	87.4	72.6
July	1.54	88.9	74.2
August	0.90	90.2	75.6
September	2.00	90.2	74.0
October	1.23	88.5	72.6
November	4.23	86.0	72.4
December	0.78	83.2	66.9

Temperatures are expressed in degrees Fahrenheit, and rainfall (precipitation) is expressed in inches. Total rainfall for the year was 13.93 inches; this is lower than normal, but the leeward side of the island is typically very arid.

C. LAND ACQUISITION

3. Other

Both units of the refuge, Waiawa unit (24.5 acres) and the Honouliuli unit (36.5 acres), are perpetual easements from the U.S. Department of the Navy. These easements were obtained in 1976. An additional 14-acre parcel, hereafter called the Waiawa Annex unit, was offered to the Service by the Navy in 1979. This unit, located approximately one-half mile south of the Waiawa unit on the same peninsula, contains a deep coastal fish pond overgrown with a dense stand of mangrove trees. The Service determined that the Waiawa Annex would require high initial development; in its present state, this unit only provides marginal habitat for endangered waterbirds. Development of the Annex unit has been delayed until additional funds for management are obtained. The City and County of Honolulu expressed an interest in a portion of the Waiawa Annex land as part of a municipal golf course.

D. PLANNING

1. Master Plan

The wetland master plan had some minor editorial changes suggested in 1986, and it was sent back to the regional office for review. The major changes for Pearl Harbor refuge suggested in the master plan include reconstruction of impoundments at both units. Waiawa Unit was reconstructed in 1985, and meetings with contractors and military agencies provide some optimism for getting reconstruction of Honouliuli Unit completed in 1987.

5. Research and Investigations

Studies by the endangered waterbird team were conducted at both Pearl Harbor units during 1986. The emphasis in data collection was for activity budget information in various wetland types. Waiawa Unit provided a unique saltwater system for observation; salinities ranged from mildly brackish to hypersaline.

Contaminant sampling was conducted on both refuge units in 1986 by refuge personnel, and the Navy had a survey of Waiawa contaminants performed by a private firm, Aquaterra Technologies. Fish tissue samples were collected for analyses by both sampling parties. Ron Block of Aquaterra suggested that invertebrates would be good indicators of heavy metals in the ecosystem if invertebrates could be reintroduced. Apparently, invertebrate populations were exterminated when pond reconstruction occurred in 1985; however, invertebrate sampling prior to reconstruction yielded extremely low species diversity. No results of the contaminant sampling was received in 1986.

Contaminant sampling of fish tissue was conducted in 1986 at all wetland refuges. Concerns about Pearl Harbor contaminants stem from the adjacent landfill that could be providing contaminants leaching into the refuge. (SB)

Another monitoring task at Waiawa Unit consisted of measuring the depth of the salt water lens in Waiawa Spring; water is pumped from this source to flood Waiawa impoundments. The tidal influence pushes salt water into the pump intake during high tidal periods, resulting in elevated salinities entering refuge ponds. Many invertebrates and plant species cannot tolerate highly brackish conditions, and apparently the invertebrates that can survive saline conditions cannot persist any length of time with great abundances of fish preying on them in the absence of good vegetative cover.

6. Other

Plans for reconstruction of Honouliuli Unit were formulated in late 1986. The refuge manager was assisted by the research assistant from the endangered waterbird study in surveying elevations of pond bottoms, levees and islands. Pond, island and levee areas were also measured to determine volumes of cut and fill involved in island and levee removal.

Reconstruction, including removal of large levees to consolide 4 ponds into 2 ponds and removal of huge islands, should provide nearly twice the wetland surface area as presently exists.

E. ADMINISTRATION

2. Youth Programs

Four YCC enrollees participated in an eight week non-residential camp during the summer. Their activities on the Pearl Harbor NWR included: clearing vegetation from fencelines, repairing fence, clearing unwanted vegetation from waterbird nesting islands, pulling mangroves from drainage canals and replacing boundary signs.

Crew leader Greg Domingo provided excellent guidance and enlightened the crew with educational visits to various cultural and environmental exhibits on Oahu.

5. Funding

The Wetland Refuges budget is allocated by the Hawaiian Islands Complex Manager. No major projects were funded at Pearl Harbor NWR in 1986, and maintenance and administrative activities were conducted from the complex office with responsibilities split between all wetland refuges.

The largest expenditure for any specific facility was the replacement of an irrigation pump at the Waiawa Unit.

7. Technical Assistance

Bill Striplin (RO-EN) and refuge staff visited Waiawa Unit in April to inspect the reconstruction project performed the previous year. The need for an improved water delivery system that could provide water of the proper salinity was also discussed.

F. HABITAT MANAGEMENT

1. General

This two unit, 61-acre refuge consists primarily of shallow man-made impoundments surrounded by service roads (one-lane, gravel) and a partial scrub forest buffer zone 30-50 feet wide. A 7-foot high chainlink fence surrounds each refuge unit. Water levels in the individual impoundments are maintained artificially by electric pumps.

2. Wetlands

Islands and open water habitat were created within both units of the refuge during the inception of the refuge. FWS investigations have indicated that these islands are too large in diameter and height. Large islands are less productive than the small islands because stilts are very territorial and will defend the entire island on which they nest. However, stilts will tolerate other stilts nesting on nearby islands. Furthermore, the high islands at 1 1/2 ' or more above the water surface, provide a dry substrate for the establishment of undesirable upland vegetation. Lower islands preclude dry land conditions and can be flooded to kill any unwanted vegetation that may become established.

In 1985, the ponds were reconstructed at Waiawa Unit resulting in smaller islands with more water surface area available. The same reconstruction should be performed at Honouliuli Unit; planning and coordination were done during the end of 1986 to achieve this end.

Waiawa Unit was reconstructed in 1985 by removing huge islands and reconstructing smaller nesting islands and a levee separating 2 ponds. This unit needs to be revegetated to improve habitat quality. (SB)

Pond bottom and island elevations were surveyed, areas were measured, and cut and fill volumes were determined. The U.S. Army showed interest in performing the dirt work for the refuge as a training exercise, and an Army engineer visited the site with refuge staff. The outcome of this meeting was promising, with the Army hoping to conduct the work in 1987 as one of their training projects.

The Waiawa unit has problems with extremely high salinities. High tides bring Pearl Harbor sea water up into Waiawa Spring. Water is pumped from the Spring into the refuge management ponds by a new 5-hp submersible pump and 600' of 4" PVC pipe. The ponds total 20 acres in size and management capabilities are limited by the restricted size and length of this pipe. Salinities within the management ponds increase as evaporation reduces the amount of fresh water thus concentrating the salts. The Service plans to reduce the salinity by rehabilitating the water intake system to take only the surface fresh water.

Both refuge units were manipulated by partial dewatering during stilt nesting season to provide nest and brood habitat. Precise water level control and fluctuations must be conducted and monitored to provide optimum breeding and rearing habitat.

3. Forests

Both units of the refuge have introduced tree and shrub species that present management problems: On their upland areas is a shrub zone dominated by kiawe (Prosopis pallida) a type of mesquite, koa haole (Leucaena), and Fleabane (Pluchea). This vegetation is fast growing and must be cleared from fencelines yearly or it will destroy them. Another tree species, the mangrove, grows on the Pearl Harbor side of the units in the brackish wetlands. This species will clog a drainage canal if not maintained yearly.

The YCC crew did a great job of clearing the fenceline around both units.

Roadways at both units were mowed and cleared of invading trees and shrubs.

10. Pest Control

Herbicide spraying is used to control exotic vegetation on the roads and fencelines of this refuge. Roundup, banvel, and rodeo are used per manufacturers instructions.

G. WILDLIFE

1. Wildlife Diversity

This refuge was established as mitigation for the loss of stilt feeding habitat when the Keehi Lagoon reef runway of Honolulu International Airport was built in 1976. As a result, the man-made wetland habitats of this refuge were designed to provide feeding and nesting areas primarily for stilts. Other endangered waterbirds, and migrant shorebirds and waterfowl have also benefited from these habitat modifications. The high salinity conditions at the Waiawa unit have restricted the diversity of avifauna compared with the fresh-water conditions at the Honoululi unit. Efforts to decrease the salinity at this unit were begun in 1980 and continued through 1985.

2. Endangered and/or Threatened Species

The Pearl Harbor Refuge is part of a wetland complex centered around the Waipio Peninsula sugar settling basins. The settling ponds provide abundant food for many stilts and shorebirds as well as lesser numbers of coots and ducks. Some stilts nest at these settling ponds, but most nesting in this complex is done on the refuge units. Both coots and stilts move between the settling ponds and refuge units, but most territorial birds remain on refuge units unless water or food conditions force them to go elsewhere. Most birds using the settling ponds are nonterritorial birds that "float" among settling ponds and occasionally visit refuge units when food is more plentiful.

Oahu Sugar leases the settling pond land from the Navy, and they use the ponds for settling the solids out of sugar cane wash water. The milling operation closes for 3 months during the winter, and for nearly 2 months no water flows into the settling ponds. As settling ponds evaporate and dry, the dependent birds may be without foraging habitat if rains don't maintain mudflats and moist soil areas.

Shorebird habitat is provided nearly all months of the year at Waipio settling ponds. This habitat may be short-lived if the sugar industry fails in Hawaii. (SB)

WAIAWA UNIT

Populations of the endangered Hawaiian stilt fluctuated with food availability. Approximately 20 stilt typically inhabited the 2 ponds at Waiawa Unit, especially during breeding season when most birds were territorial. Up to 40 stilts were observed at Waiawa following a rapid draw-down that concentrated lots of small fish.

It was estimated that 6 stilt were fledged from Waiawa Unit in 1986.

Coot numbers also fluctuated, dependent on water conditions. Typical numbers at Waiawa totaled 18 birds. Coot nesting occurred at Waiawa in the saline conditions; 3 nests by 2 pairs of coots were initiated, the one nest that successfully hatched was unsuccessful at keeping any young for longer than one week. It is suspected that the scarcity of invertebrates was responsible for preventing coot chick survival.

Koloa were occasionally observed at Waiawa ponds; usually one pair was seen, but once 2 pairs were observed. No koloa nesting was documented at this unit.

No endangered moorhens were seen at Waiawa Unit in 1986, and none have been documented in the past. The saline water and lack of robust emergent vegetation apparently precludes moorhen usage.

HONOULIULI UNIT

The fresh water habitat at the Honouliuli unit is used by all four of Hawaii's endangered waterbirds; the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. Stilt numbers were variable as at Waiawa Unit. Typical numbers of stilt observed ranged from 10 to 20. About 8 pairs were territorial with most of them nesting. An estimated 2 stilt young were fledged from this unit.

Coot numbers were variable depending on amount of emergent vegetation present and water levels. From 8 to 22 coots typically inhabited Honouliuli Unit. There were approximately 3 coot nests during 1986 with an estimated 4 young successfully fledged.

The moorhen also moved among the ponds and bordering wetlands throughout the year. Typically, 2 pairs of moorhen used the refuge unit with an estimated 4 young fledging from 2 nests.

Moorhen pairs were quick to utilize annual emergent vegetation for nesting after it was provided by dewatering the pond to allow germination. (SB)

Koloa numbers were variable, with these ducks being most abundant during the winter months. Typically, 10 to 20 koloa were present during fall and winter with fewer than 10 observed during spring and summer months. Two nests were documented in 1986, but no fledging of young was observed.

3. Waterfowl

Wintering and migrating waterfowl use both units of the refuge during the spring, fall, and winter months.

The brackish, open-water habitat at Waiawa supported a pair of scaup through most of the winter months and an occasional shoveler was observed. Honouliuli Unit maintained a mixed bunch of shoveler, pintail, and a fw green-winged teal throughout the winter months. Reflooding annual vegetation in late fall 1986 provided habitat for up to 70 ducks at times.

4. Marsh and Waterbirds

Waiawa Unit:

The native black-crowned night heron was commonly seen in this unit throughout the year. Heron numbers averaged approximately 10 birds; numbers fluctuated somewhat, especially when drawdown of ponds made more fish available.

Cattle egrets were less numerous. Counts ranged from 1 to 5 throughout the year.

Honouliuli Unit:

Black-crowned night heron and catlle egret numbers at Honouliuli Unit were very similar to those observed at Waiawa.

5. Shorebirds, Gulls, Terns, and Allied Species

Waiawa Unit:

The Waiawa unit had more shorebird usage than Honouliuli, due to more mudflat habitat. The most common shorebird during migration and winter months was the lesser Pacific golden plover with over 140 birds observed during early fall migration. The ruddy turnstone was also frequently observed during the same months as the plovers with over 50 observed in November. Up to 20 sanderlings were also seen during migration. Wandering tattlers were observed frequently; average numbers were 2 with up to 8 being present during migration. One least tern was seen flying and feeding at Waiawa on several occasions throughout the latter part of 1986.

Mudflat habitat in Waiawa ponds provide good loafing habitat for ruddy turnstones, and large flocks are sometimes seen during the fall and spring migrations. (SB)

The Honouliuli Unit:

The same shorebird species that are found at Waiawa also use Honouliuli Unit during the same time periods. Shorebird numbers at Honouliuli are typically less than those found at Waiawa. Additional species found at Honouliuli that typically do not occur at Waiawa include both long and short-billed dowitchers.

A small group of dowitchers winters in Hawaii every year. These shorebirds travel to various wetlands and apparently select the best habitat they can find for feeding. (SB)

6. Raptors

A lone osprey has also taken up residence here in Hawaii. It was commonly observed throughout the year at the Waiawa Unit. The bird was very common at Waiawa during the drawdowns, when easy catches of fish could be made.

11. Fisheries Resources

There are tremendous abundances of fish in both Pearl Harbor units, with a dynamic resource of estuarine fish in Waiawa. The stilts apparently utilize small fish as food throughout the year, but it is suspected that fish are impacting invertebrate populations and aquatic plant growth due to their hight densities.

15. Animal Control

Live traps were set by YCC during summer months to catch mongoose and cats. The mongoose is a prolific animal that is an efficient predator on the waterbirds and their young. The trapping program is designed to reduce their numbers during peak waterbird nesting periods. Thirty-two trap days resulted in capturing 41 mongoose and 4 cats.

H. PUBLIC USE

1. General

The urban, yet secluded location of this refuge presents a great potential for environmental education. The small area of each unit would restrict the size of school groups and season of visits to minimize disturbance to the endangered waterbirds. Special teacher-training sessions could easily be accommodated with lesson plans designed to maximize the learning experience during subsequent brief visits by school groups. Budget and staff limitations thus far limited such activity.

In April, 7 biologists with the state Division of Forestry and Wildlife visited Waiawa Unit with the Refuge Manager to observe the results of reconstruction conducted the previous summer. Pond improvements were noted, but a need for revegetating the unit was apparent; this would also help establish better invertebrate diversity and abundances.

11. Wildlife Observation

Two individual bird watchers received permits to visit the refuge throughout 1985. Their time includes less than 50 hours of use per year. Their wildlife observations supplement our monthly wildlife censuses.

17. Law Enforcement

There has been a perennial problem with a few night fishermen from the Pearl City area who insist upon walking through the Waiawa unit to fish off the refuge in Pearl Harbor. They repeatedly cut holes in our boundary chainlink fence, which we repeatedly repaired. This past year, more fishermen appeared to bypass the refuge and trespass was not as much of a problem as in previous years.

I. EQUIPMENT AND FACILITIES

2. Major Rehabilitation

Reconstruction of impoundments at Hoouliuli Unit was planned during the latter part of 1986; Ron's Construction and the Army visited the site to evaluate their prospects of performing the work. Ron Oshiro of Ron's Construction felt the job was much too large for him to do without a contract of at least 90K. The Army showed interest in performing the work as a training exercise for heavy equipment operators.

A private developer indicated an interest in performing some work at this location as mitigation for a Section 404 violation at another site in Pearl Harbor. The Corps of Engineers did not want to set a precedent by allowing a developer to perform off-site mitigation.

Hopefully the Army will follow through with their intentions of performing reconstruction work in 1987.

3. Major Maintenance

The two electric pumps that provide water for the two units of the refuge were periodically lubricated and serviced during the year.

Pond 1 at Honouliuli had some island shaping conducted by the maintenance worker and refuge manager during late summer. Large islands were levelled and small islands were constructed to provide stilt and duck nesting habitat.

4. Equipment Utilization and Replacement

The 3-hp irrigation pump at Waiawa was replaced in 1986 after it quit working. A new 5-hp submersible pump was purchased and installed by force account to provide water to the Waiawa ponds.

J. OTHER ITEMS

1. Cooperative Programs

The refuge is fortunate to be able to use a portion of the U.S. Navy motorpool area for storage. The area is located adjacent to the Waiawa unit. The JD 302 tractor, with its implements are stored in this secure location. They also provide us with some additional enclosed storage for fencing and other hardware materials.

KAKAHAIA NWR

ANNUAL NARRATIVE REPORT

Calendar Year 1986

U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

Kakahaia NWR is a coastal freshwater pond, originally formed and used as a man-made fishpond. This 44.6 acre refuge is situated along the south coast of the island of Molokai, Hawaii, 5 miles east of the city of Kaunakakai. The refuge was established in 1976 to provide habitat for the endangered coot. In 1983, an impoundment was constructed on the Refuge to provide additional shallow water habitat for the endangered stilt. The refuge is surrounded by kiawe (Prosopis sp.), woodlands on the north, east, and west. Hawaii State Route 450 bisects the refuge in its southern half. The two acres seaward of the highway are under Special Use Permit to the County of Maui for use as a County Park.

A view of Kakahaia fishpond is an esthetic sight from the mountainside to the north of the refuge. This photo also shows encroachment of bulrush with a diminishing open water area if compared with older photos. (SB)

KAKAHAIA NATIONAL WILDLIFE REFUGE

F. HABITAT MANAGEMENT

G. WILDLIFE

H. PUBLIC USE

H. PUBLIC USE (Cont.)

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

A volunteer maintenance crew cleared brush during a 3-day field camp (Sec. I.3). Bulrush (Scirpus spp.) was sprayed with herbicide and burned in an experimental attempt to find a control method (Sec. I.3). The windmill pump used for water delivery had the drive gears break due to excessive stress, and it was repaired (Sec. I.2).

B. CLIMATIC CONDITIONS

The nearest weather recording station, Molokai Airport, is located 10 miles west of the refuge. Temperature and rainfall data from this station, which is at a higher elevation than the refuge, does not accurately reflect the conditions at the refuge. No wind speed data are available for the island of Molokai. General weather conditions are similiar to that reported for the Honolulu Weather Observation Station.

The refuge is located on the leeward side of the island of Moloka'i. The refuge typically receives annual rainfall of 20-30 inches. Occasional storms will cause flooding in coastal areas near the refuge. However, 1986 was drier than normal with only 5.4 inches of rain falling in nearby Kaunakakai.

Winds during the early part of 1986 were light and variable, thus minimizing the amount of water pumped into the impoundment from the windmill. The water level in the moist-soil impoundment gradually decreased throughout the summer until the windmill broke down in September.

C. LAND CONDITIONS

1. Fee Title

One parcel of private property on the north side of the refuge is surrounded by refuge land on three sides. This parcel belongs to the heirs of Sadakara. The property is located close to one of the refuge's main water springs and less than 50 feet from the wetland. Presently it is unoccupied; however, this may not be the case for very long. Owners and realtors have been showing this parcel and other properties to prospective buyers.

2. Easements

A lot bordering the north side of the Refuge is owned by a private individual intending to construct a house on the site. Authorization for an entry easement has been given and maintenance conditions have been clarified. Impacts of his proposed residence on the Refuge and endangered waterbirds have also been discussed.

3. Other

The refuge revenue sharing check for Kakahaia NWR was mailed to Maui Mayor Tavares on June 25, 1986. The $4,731.00 check was based on .75% of the appraised fee value.

E. ADMINISTRATION

1. Personnel

Kakahaia NWR is an unmanned station. The Refuge is typically visited once a month to census birds, perform light maintenance, and check water conditions. Intermittent visits occur to work on various projects or meet individuals with Refuge-related concerns or requests. Regular maintenance and bird counts are conducted during these visits if time allows.

2. Management Plan

A Sport Fishing Plan and Environmental Assessment of fishing impact on Kakahaia Refuge was drafted and submitted to the Regional Office in January. The plan and assessment were approved and finalized in May.

The Sport Fishing Plan identifies the fishery resource and use received from fishermen. Fishing is conducted from the beach into public ocean waters, so regulations were adopted from the state fisheries regulations.

This plan was announced in the Federal Register to formally put it into effect.

5. Funding

A large ARMM funding package of 26.0 K for Kakahaia NWR was instrumental in funding vegetation removal and fence clearing work for wetland habitat improvements.

F. HABITAT MANAGEMENT

1. General

This 44.6 acre refuge consists of a centrally located 15 acre spring-fed wetland area that at one time was an ancient Hawaiian fishpond. Later it was used for rice and taro cultivation. A moist soil impoundment abuts this wetland to the west. This entire wetland area is bordered by a two-lane highway on the south, and scrub forest (22 acres) surrounds the remaining sides.

2. Wetlands

When this refuge was first established, it contained a total of 15 acres of wetland habitat. This wetland now consists of 4 acres of open water surrounded by 11 acres of dense bulrush. A thick algal mat coveres 50-80% of the open water area. Waterbird use of this spring-fed wetland was restricted, for the most part, to the open water pond (average depth ca. 50-70 cm.) and the bulrush border surrounding the open pond.

In 1983, the refuge expanded the waterbird habitat by completing two projects during the summer of 1983: (1) the 11-acre bulrush stand was partially opened by creating radiating channels from the central open water pond. A Menzi Muck backhoe was contracted to do the work. The channels were excavated to a depth of 4 feet by 15 feet wide. A perimeter moat was excavated around the entire wetland to the same dimensions. The moat serves as a barrier to the alien mongoose, which is the primary predator of nesting waterbirds. (2) The main bulrush wetland contains no mudflat habitat. Thus, the area is used only by coots and waterfowl. In order to create habitat for the endangered stilt and diversify wetland habitat on the refuge, an open flat area, approximately 5.5 acres, along the west side of the refuge was converted into a shallow impoundment. Small nesting islands were constructed in the center of this impoundment. This pond is managed at depths ranging from 0" to 1 1/2 feet. A windmill was erected between the two wetlands to fill the newly created 5.5-acre shallow water impoundment. Water is pumped from the spring-fed 15-acre wetland to the new impoundment.

THE 5.5-ACRE MOIST-SOIL IMPOUNDMENT

Ideally, the refuge would like to maintain high water levels from October through March in the new impoundment. This would increase habitat for wintering waterfowl and coots. In April the pond would be drawn down to provide stilt nesting habitat. Water levels would be manipulated through summer months to provide optimum mudflat and shallow water habitat for stilt broods. Dewatering would also allow germination and growth of moist-soil plant species for the upcoming fall and winter months. The entire month of September would be available for the slow build up of the pond to the desired high winter water level.

The windmill water delivery system for the moist-soil impoundment does not adequately provide water to the pond. Winds on the lee side of Molokai are variable, and can be limited to the extent that the windmill will not pump an appreciable amount for up to 2 weeks. The windmill was rigged with 4- six inch pumps for the first half of 1986, until the gearbox shattered from being overloaded. Infrequent, monthly visits do not allow adequate monitoring of windmill operation, and it is not known what the optimum load would be on the windmill. After repairing the broken gears, it has been decided that only 2 pumps will be powered at a time, and a supplementary water delivery source should be installed.

Water levels in the moist-soil impoundment were lower than desired throughout 1986. Full-pond levels were never reached during the winter months, and light winds resulted in premature dewatering through the summer months. After the gearbox was broken in September, no water was pumped into the pond until repairs were completed in December. Lush stands of millet (Echinochloa crusgalli), makai (Scirpus maritimus) and sprangletop (Leptochloa uninervia) sprouted and matured as a result of the drawdown and timely rains.

Lack of water flow allowed the moist-soil impoundment to dry through the fall months, but rains were adequate to allow growth of desirable annual plant species. (SB)

KAKAHAIA BULRUSH POND

The dredged channels in the old fishpond are being overtaken by exotic vegetation at a rapid rate. The spoil dikes are also getting more upland plant establishment on them; some kiawe trees are growing rapidly and need to be cut periodically.

A culvert extends under the highway to the ocean beach for drainage of the main wetland. In previous years the county maintained this culvert by occasional removal of the sand plug; the plug was not removed by the county in 1986 and it helped maintain high water levels in the old pond. High water levels inhibit further encroachment of bulrush into the pond, and high levels also assure a water source for the impoundment when needed. The old pond cannot be completely drained, but extended periods of low water levels would permit more establishment of dry-site plant species into wetland vegetation.

3. Forests

Upland areas of the refuge are covered by dense stands of haole koa (Leucaena glauca), kiawe (Prosopis pallida), and Pluchea spp.

10. Pest Control

A crew of refuge personnel and volunteers spent 3 days at Kakahaia Refuge in January clearing overgrown Pluchea along the perimeter dike of the old pond. Clearing of woody vegetation along the boundary fence was also performed (Sec. I.3).

An experimental patch of bulrush was sprayed with Rodeo in April for a controlled burn experiment. The burn was performed in June resulting in a larger burn area than anticipated (Sec. I.3).

A maintenance contract for vegetation clearing of fencelines and perimeter dikes was awarded to Keoki Dennison in April. This maintenance contract lasted throughout the year. (Sec. I.3).

11. Water Rights

Development of an agricultural/residential subdivision, Kawela Plantations, which borders the refuge to the north and west, began in 1980. This 6,000-acre subdivision contains 210 two-acre fee-simple lots. The first house was completed during the summer of 1983. Roads and utilities have been installed for the subdivision. Three wells were drilled within 1,600-2,000 feet of the refuge boundary. This development and its water use may have detrimental impacts on the refuge. A Stevens water level recorder, installed along the west side of the 15-acre open water area in 1980, continued to document baseline water data throughout the year.

G. WILDLIFE

2. Endangered Species

The Hawaiian coot and stilt are two endangered species normally encountered on the refuge. Management of wetland habitat on Kakahaia Refuge is oriented toward these endangered species in addition to migrant shorebirds and waterfowl.

Coot populations were variable, ranging from as few as 30 during the wet winter months to as many as 110 during dry fall months. Apparently, coots move between different wetlands on Molokai, and possibly to and from adjacent islands. Habitat availability varies seasonally, especially on this dry side of the island, and it is presumed that bird movements occur to take advantage of good wetland habitat as available. Coot nesting

occurred throughout most of the year with 3 or 4 pairs consistently observed nesting, especially through the early summer months. It is not known if the same pairs are territorial and maintain these territories throughout the year. Apparently with higher coot densities there is a reduction in nesting, but the same resident breeders may persist until competition decreases allowing them to nest.

Hawaiian coots are the most common endangered species encountered at Kakahaia Refuge; considerable nesting and maintenance habitat is provided for coots. (SB)

Stilt counts were variable throughout the year. A high count of 51 was recorded in September, presumably as a result of the impoundment drawdown due to malfunctioning of the windmill. Other counts typically documented 12 to 18 stilts using the refuge. There were a few territorial pairs of stilt using the moist-soil impoundment during the 1986 breeding season, but only one successful nest was documented; it was estimated that 2 stilts fledged from this nest.

One Hawaiian moorhen was sighted occasionally during 1986. This bird is apparently a survivor of 6 birds transplanted in 1983 to Kakahaia Refuge.

3. Waterfowl

Migrant waterfowl use of the refuge was noted during the winter months. Northern shoveler, pintail, American wigeon, and green-winged teal are commonly seen on the refuge from September through April.

MONTHLY WATERFOWL CENSUS - 1986

	Shoveler	Gr-wg Teal	Am Wigeon	Pintail	E.Wigeon
JAN	28			15	
FEB	36	3	4	12	
MAR	1				
APR	3				
MAY	2				
OCT	9		1		
NOV	23	2	4	10	2
DEC	27	2	1	200	

Other migrant waterfowl included 4 black brant that were present in February and March; 1 brant was present from January through April. One ring-necked duck was present in February, and a resident fulvous whistling duck was observed on the refuge throughout the year. The fulvous whistling duck was apparently an individual that dispersed from the population establishing itself on Oahu.

Northern shovelers are the most commonly seen migrant duck species at Kakahaia NWR. (SB)

4. Marsh and Waterbirds

Only a few indigenous black-crowned night herons are regularly observed around the edge of the open water area or roosting in nearby trees. Numbers typically ranged from 3 - 13. No heron nesting was observed on the refuge during 1986.

Cattle egrets are occasional visitors to Kakahaia Refuge; typically 2 or 3 birds can be seen on the periphery of the wetlands.

A great blue heron was frequently seen on the refuge throughout the year. This mainland visitor apparently found its way here by accident after being lost in a storm and has taken up residency. Sightings of great blue herons have been reported on other islands; it is not known if these sightings are of other birds or this same individual.

5. Shorebirds, Gulls, Terns, and Allied Species

The 5.5-acre impoundment provides shorebird habitat for the refuge. These shorebirds are migrating and wintering birds that use the refuge during the fall, winter, and spring months. Common species include: lesser golden plover (2-4), ruddy turnstone (2-4), sanderling (1-2), and wandering tattler (1-2).

One pectoral sandpiper was observed during the month of November.

10. Other Resident Wildlife

Occasionally francolins (gray, black) can be heard calling as they use the upland areas of the refuge. These are introduced game birds.

Axis deer can be found in the thick kiawe forest on the refuge, and they drink water regularly at the bulrush pond.

15. Animal Control

The mongoose is an abundant mammalian species on the island of Molokai. Normally the refuge traps these animals on the endangered waterbird refuges. Limited trapping was performed during 1 visit to the refuge in April. The timing of this trapping session was intended to benefit coots that were nesting at that time and stilt that were preparing to nest.

H. PUBLIC USE

1. General

Kakahaia NWR is located immediately adjacent to the southern coastal highway and only 5 miles east of Kaunakakai, the largest town on the island. Traffic on this road is very light and most travelers pass by the refuge without seeing this important wetland. A tall, dense stand of bulrush shields any view of the open pond from the highway.

9. Fishing

Molokai residents fish from the beach along the Maui County park, which is under SUP from the refuge. Public use data are difficult to obtain due to night fishing and our infrequent visits to the refuge. Estimates derived with the assistance of the state fishery biologist for Maui County suggest that approximately 25 fisherman use the area an average of 2 hours per month each.

14. Picknicking

A day-use picnic area was constructed in 1978 on the ocean-side of the highway intersecting the refuge and continues to be maintained by the County of Maui. The concrete tables, constructed by the YCC in 1978, and metal barbeque grills are used on a limited basis by local residents and tourists. No view of the wetland area is presently available from the

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

An eight-foot Dempster windmill was constructed during the summer of 1983. The mill lifts water from the 15-acre Kakahaia pond to the shallow water impoundment. This windmill was working adequately through most of 1986 until September when excessive stress shattered the drive gears.

The process to disassemble the windmill head was time-consuming for the 2 wetlands refuge personnel, but the gearbox was taken apart and replacment parts were ordered. All necessary parts were received by late October and after a few day trips to Molokai, the windmill was reassembled and running by December. The research assistant for the endangered waterbird study helped raise and install the heavy wheel on the last day when repairs were completed.

Only 2 pumps were hooked up to the windmill in hopes that it would not be overloaded again. The light, variable winds on the leeward side of Molokai do not ensure consistent pumping by the windmill. To provide adequate water volumes to the moist-soil impoundment, refuge staff checked the cost and feasibility of installing an electric pump to supplement the windmill and provide water to reflood the impoundment in the fall.

Molokai Electric said they could provide power to the refuge if we would provide a site plan and circuitry blueprints. The distance from the proposed service hook-up provided by Molokai Electric to the windmill sump where the submersible pump would be installed is 700 feet. Electrical cable required for 240 volt current would be very expensive, so an electrical contractor suggested we use 480 volt current to reduce the wire needs.

The refuge is planning to install a 480 volt submersible pump in the windmill sump, with direct burial cable from the pump control panel to the meter loop that Molokai Electric would tie into. We hope this can be done next summer to allow flooding capability for fall and winter migrants.

3. Major Maintenance

A crew consisting of 4 Service personnel and 5 volunteers set up a 3-day field camp at Kakahaia Refuge in January. Major projects included windmill maintenance and overhaul of the 4 windmill pumps. A major effort at removing exotic Pluchea spp. from the perimeter dike of the old pond was also performed. Other vegetation removal was done around the boundary fence, and some woody species, including kiawe, were removed from spoil dikes inside the old pond.

The January field camp crew enjoyed peaceful camping on Kakahaia NWR after a hard day of manual labor. This atmosphere is much different from the noisy congested activity of Honolulu. (SB)

Another field camp consisting of 2 Service personnel and one volunteer performed work in April. Windmill maintenance and vegetation control were the main tasks undertaken during this visit.

Some vegetation control included spraying of a patch of bulrush in the old pond with Rodeo herbicide for a planned experimental burn. The controlled burn was conducted in June after the pond had been dewatered as much as possible since May. Three refuge staff participated in the controlled burn. The sprayed bulrush burned very easily, and accumulated litter from unsprayed bulrush also burned, resulting in a burn area greater than twice the anticipated burn size.

Both sprayed and unsprayed areas burned very clean, but unsprayed bulrush resprouted and was reestablished within six weeks, the sprayed area took nearly 5 months before it was reestablished with bulrush. It is not known if the bulrush that became established in the sprayed area encroached by rhizome or resprouted from existing rootstock. It appeared that the majority of the plants resprouted from rootstock, and if so, it may be very difficult to eradicate this species that has up to 6 growth cycles per year.

The old pond was reflooded after burning by use of the water control structure; some leaks were also patched in the structure and rock and soil material was added to stabilize the inlet end.

A contract for vegetation maintenance along the boundary fence and perimeter dike was released for bid in March. The contract was awarded to Keoki Dennison in April, and his crew performed good maintenance throughout the year.

6. Energy Conservation

The eight foot Dempster windmill offers considerable savings in electric pumping costs. The spring through late summer winds along the Molokai shoreline are fairly constant at 10-15 mph. during the day, but die down at night. The greatest water needs occur in the fall when winds are not reliable, and as a result the refuge needs to install an additional electric pump as a backup during periods of little wind.

The eight foot Dempster windmill provides a cheap source of water; unfortunately, the volume and timing is not reliable and monthly monitoring cannot always keep it running effectively.(SB)

J. OTHER ITEMS

1. Cooperative Programs

The refuge is fortunate to have good relations with the local Department of Land and Natural Resources - Forestry workers. They allow us to store our equipment and supplies in their secure maintenance yard. In addition, if we are in dire need of manpower assistance, they will lend a helping hand.

3. Credits

Berendzen wrote this narrative.