

HAWAIIAN & PACIFIC ISLANDS NWR COMPLEX

ANNUAL NARRATIVE REPORT

Calendar Year 1985

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

## INTRODUCTION

The Hawaiian and Pacific Islands National Wildlife Refuge (NWR) Complex consists of thirteen National Wildlife Refuges. There are five wetland refuges in the complex which are inhabited by endangered waterbirds unique to the Hawaiian Islands and a variety of migratory waterfowl and shorebirds that visit the Pacific Islands during winter months. Two wetland refuges, the Pearl Harbor NWR, established in 1976 and consisting of two units totalling 61 acres, and the James Campbell NWR, established in 1977 and consisting of two units totalling 142 acres, are located on the island of Oahu. The island of Kauai has two wetland refuges, the Hanalei NWR established in 1972, consisting of 917 acres, and the Huleia NWR established in 1973, totalling 238 acres. One wetland refuge, the Kakahāia NWR, located on the island of Molokai, was established in 1976, and consists of 45 acres.

Six remote island refuges in Hawaii and the Central Pacific make up the bulk of the land base/acreage within the complex. These refuges support literally millions of breeding seabirds, unique land birds, and a variety of other marine species, including endangered seals and turtles that inhabit extensive nearshore reefs and lagoons. The largest and most complex of the remote island refuges is the Hawaiian Islands NWR, established in 1909 and managed as a 254,500 acre unit, including 1,740 acres of fast land. Johnston Atoll NWR was established in 1926 and consists of 691 acres of fast land and 12,000 acres of submerged land. Baker Island NWR, Howland Island NWR, and Jarvis Island NWR are equatorial refuges and were all established in 1974. Baker Island NWR consists of 340 acres of fast land and 31,397 acres of submerged lands; Howland Island NWR is made up of 400 acres of fast land and 32,419 acres of submerged land; Jarvis Island NWR consists of 1,100 acres of fast land and 36,419 acres of submerged land. All three refuges are uninhabited. Rose Atoll NWR, approximately 10° below the equator, was established in 1973 and consists of 20 acres of fast land and 1,600 acres of submerged reef and lagoon. Rose Atoll NWR is also uninhabited.

The twelfth unit within the complex is the Kilauea Point NWR on Kauai. This site of 31 acres provides habitat for several resident seabird species and doubles as the Service's primary visitor interpretation site. The site was owned by the U.S. Coast Guard until February 15, 1985, when administrative procedures were completed to transfer the area from the Coast Guard to the Service. The Service had been managing the area under permit from the Coast Guard since 1978 when the Department of Transportation discontinued use of the navigation beacon and lighthouse facility on the Point.

The Hakalau Forest NWR was established on October 29, 1985, thus becoming the thirteenth unit within the refuge complex. Acquisition for the year totalled approximately 8,300 acres. Total planned acquisition exceeds 33,000 acres. The action is in accord with the approved recovery plan for endangered Hawaiian forest birds. The new refuge is located on the windward slopes of Mauna Kea on the Big Island of Hawaii between 4,500 feet and 6,800 feet elevation. The objectives of the acquisition are: 1) to set aside lands to assure protection and perpetuation of the high elevation Hakalau rain forest, and 2) to provide for the continued existence of habitats essential to the survival of several endangered forest bird species including the akiapolaau, Hawaiian akepa, Hawaiian creeper, Hawaiian hawk, and the o'u, along with the Hawaiian hoary bat and an undetermined number of threatened or endangered plants.

The entire refuge complex is administered from the Honolulu headquarters located on the 5th floor of the Prince Jonah Kuhio Kalaniana'ole Federal Building, 300 Ala Moana Boulevard, in downtown Honolulu.

HAWAIIAN & PACIFIC ISLANDS NATIONAL WILDLIFE REFUGE COMPLEX

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NTR

PERSONNEL 1985

|                         |  |                  |
|-------------------------|--|------------------|
| 1. Noreen Bautista      | Clerk-Typist GS-4 (PFT)                                    | (Kauai)          |
| 2. Edward Bean          | Biological Aid GS-3 (Temp.) EOD 3/18/85                    | (Honolulu)       |
| 3. Stephen Berendzen    | Student Trainee (Wildlife Biology) GS-5 (Temp.) EOD 4/1/85 | (Honolulu)       |
| 4. Richard Bottomley    | Maintenance Worker WG-5 (Temp.)                            | (Kauai)          |
| 5. Katherine Castelo    | Refuge Assistant GS-6 (PFT)                                | (Honolulu)       |
| 6. William Cooke        | Fish & Wildlife Biologist GS-9 (Temp.) EOD 7/30/85         | (Johnston Atoll) |
| 7. Bruce Eilerts        | Biological Technician GS-5 (PFT) Term 5/24/85              | (Honolulu)       |
| 8. Gale Fairaizl        | Biological Aid GS-3 (Temp.) Term 1/18/85                   | (Tern Island)    |
| 9. Steven Fairaizl      | Ass't. Refuge Manager GS-9 (PFT) Term 1/18/85              | (Tern Island)    |
| 10. Stewart Fefer       | Supervisory Wildlife Biologist GS-12 (PFT)                 | (Honolulu)       |
| 11. Margaret Hardwick   | Clerk-Typist GS-3 (Temp.) EOD 5/13/85 Term 7/5/85          | (Honolulu)       |
| 12. Shirley Hernandez   | Clerk-Typist GS-4 (PFT)                                    | (Honolulu)       |
| 13. Darcy Hu            | Wildlife Biologist GS-5 (PFT)                              | (Honolulu)       |
| 14. James Krakowski     | Refuge Manager (Wetlands) GS-11 (PFT)                      | (Honolulu)       |
| 15. Jerry Leinecke      | Complex Refuge Manager GM-13 (PFT)                         | (Honolulu)       |
| 16. Larry Martin        | Ass't. Refuge Manager GS-7 (PFT) EOD 2/4/85                | (Tern Island)    |
| 17. Duane McDemond      | Biological Technician GS-5 (Temp.) EOD 3/18/85             | (Honolulu)       |
| 18. Daniel Moriarty     | Park Ranger GS-9 (PFT)                                     | (Kauai)          |
| 19. Maura Naughton      | Ecologist GS-7 (CS)  | (Honolulu)       |
| 20. Audrey Newman       | Biological Aid GS-3 (Temp.) Term 7/19/85                   | (Honolulu)       |
| 21. Tim Ohashi          | Wildlife Biologist GS-7 (PFT) EOD 3/18/85                  | (Honolulu)       |
| 22. Anne Robb           | Clerk-Typist GS-3 (Temp.) EOD 7/8/85                       | (Honolulu)       |
| 23. Nancy Sautter       | Clerk-Typist GS-3 (Temp.) Term 4/5/85                      | (Honolulu)       |
| 24. Richard Vetter, Jr. | Ass't. Refuge Manager GS-9 (PFT) EOD 3/13/85               | (Tern Island)    |
| 25. Richard Wass        | Refuge Manager (Remote Islands) GS-11 (PFT)                | (Honolulu)       |
| 26. David Woodside      | Maintenance Worker WG-6 (PFT)                              | (Honolulu)       |

VOLUNTEERS

1. Stephen Berendzen
2. Tanda Berendzen
3. Patrick Ching
4. Sheila Conant
5. Jan Dierks
6. Sheila Doyle
7. Christine Fraley
8. Wayne Gagne
9. Robin Hanford
10. Suzan Harada
11. Todd Heskett
12. Cynthia Krakowski
13. Cheryl Kval
14. Frank Magee
15. Emmy Lou Miller
16. Susan Miller
17. Bill Muench
18. Denise Mungioli
19. Tracy Nakano
20. Robert Pyle
21. Anne Schreiber
22. Ralph Schreiber
23. Joan Suther
24. Theresa Tibbitts
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YCC

1. David Smith - Oahu
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3. Kathy Valier - KPNWR
4. Enrollees - KPNWR (6)



REVIEW AND APPROVALS

Jerry F. Leinche 2/11/87  
Submitted by Date

Allan Marmelstein 13 Feb 87  
Pacific Islands Administrator Date

Suzanne R. Whelan 3/1/87  
Regional Office Review Date

HAWAIIAN & PACIFIC ISLANDS NWR COMPLEX



Left to Right:

Susan Miller, Volunteer Librarian; Molly Jones, Secretary (Administrator's Office); Jerry Leinecke, Refuge Complex Manager; James Krakowski, Refuge Manager (Wetlands); Katherine Castelo, Refuge Assistant; Richard Wass, Refuge Manager (Remote Islands); Tim Ohashi, Wildlife Biologist; William Cooke, Fish and Wildlife Biologist (Johnston Atoll); Stewart Fefer, Supervisory Wildlife Biologist; Duane McDermond, Biological Technician; Shirley Hernandez, Clerk-Typist; Allan Marmelstein, Pacific Islands Administrator; Anne Robb, Clerk-Typist.

WETLANDS STAFF



David Woodside, Maintenanceworker (on left) and Stephen Berendzen, Assistant Refuge Manager (Wetlands).

REMOTE ISLANDS STAFF



Left to Right:

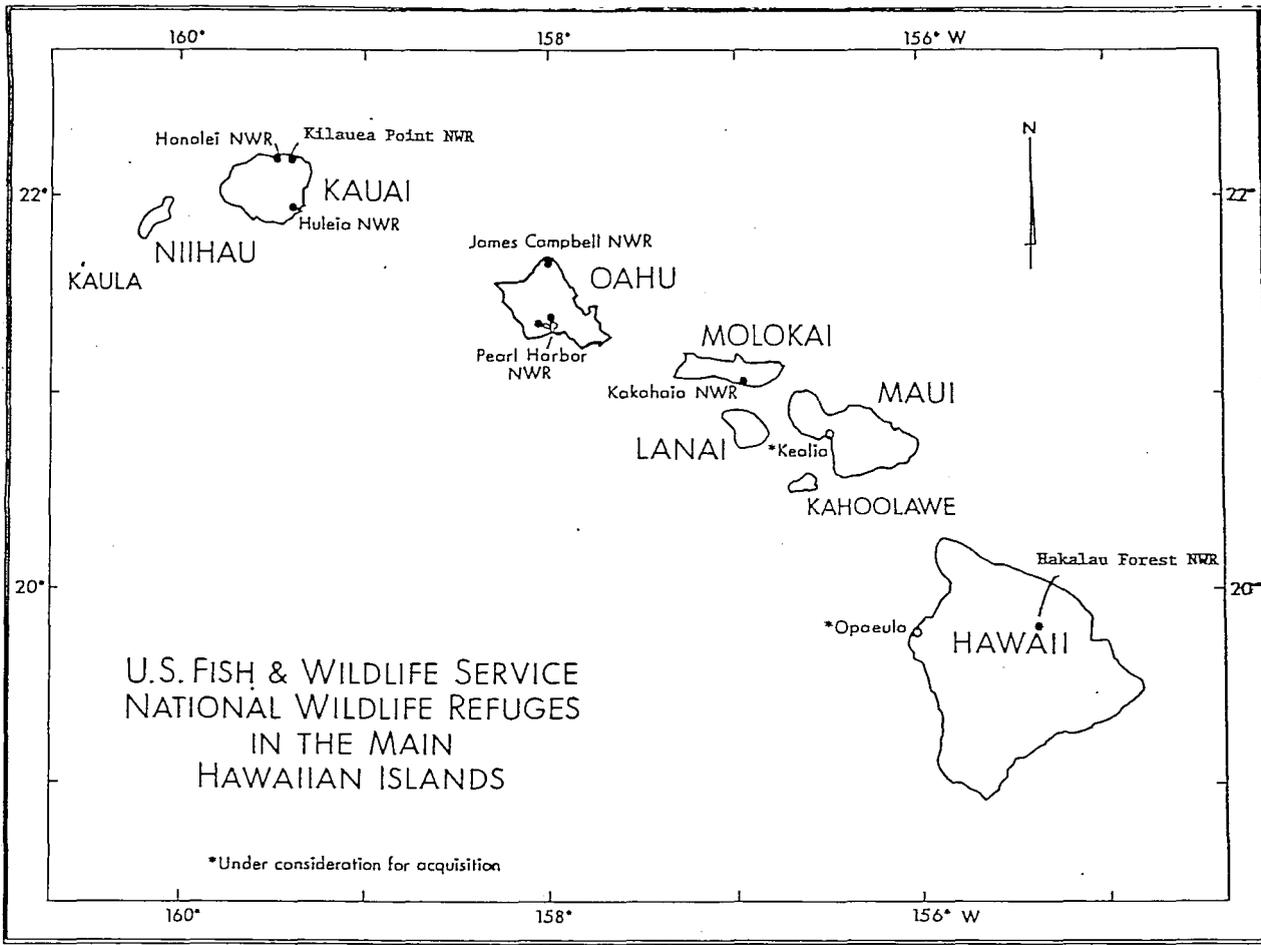
Rick Vetter, Refuge Manager (Tern Island); Richard Wass, Refuge Manager (Remote Islands); Duane McDemond, Biological Technician; Larry Martin, Assistant Refuge Manager (Tern Island).

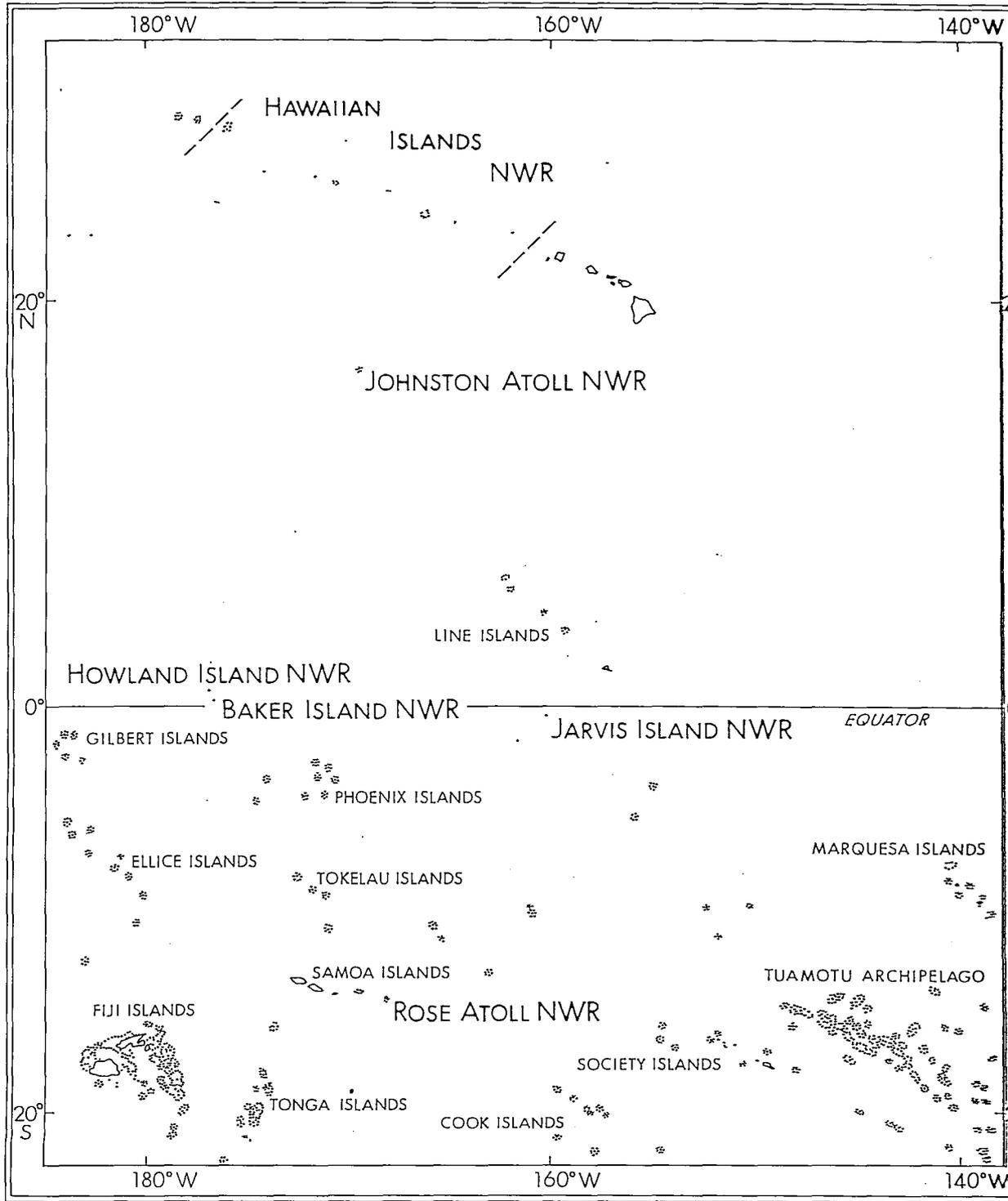
KILAUEA POINT NWR STAFF



Left to Right:

Richard Bottomley, Maintenance worker; Noreen Bautista,  
Clerk-Typist; Daniel Moriarty, Park Ranger.





Fish and Wildlife Service

HAWAIIAN AND PACIFIC ISLANDS  
 NATIONAL WILDLIFE REFUGE COMPLEX  
 Remote Island Refuges

UNITED STATES  
 DEPARTMENT OF THE INTERIOR

## B. CLIMATIC CONDITIONS

The refuge complex experiences tropical to sub-tropical weather conditions with a fairly constant northeast tradewind. The remote island refuges had a close encounter with Hurricane Nele in October, which did bring more rain and wind than usual. (See individual refuges for more climatic data.)

## C. LAND ACQUISITION

Refuge staff made additional progress on acquisition studies for two areas of prime wildlife value in the State of Hawaii. Kealia Pond is a wetland site on the island of Maui that is of major importance to endangered waterbirds, particularly the Hawaiian stilt. Midway Atoll, located northwest of the Hawaiian Islands NWR, supports a large population of breeding seabirds and remnant populations of threatened green sea turtles and endangered Hawaiian monk seals. Acquisition efforts relating to the transfer of Coast Guard title at Kilauea Point are addressed in sections relating to that specific refuge.

### 1. Fee Title

Efforts to acquire Kealia Pond from Alexander and Baldwin, Inc. (A&B) were initiated in 1971 when Director Greenwalt approved the appraised price of \$502K for acquiring 747 acres of endangered waterbird and migratory bird wetlands. Delays in acquisition occurred as a result of stalemated negotiations due to price differences and undetermined locations of several private inholdings (Kuleanas).

Early in 1985, FWS offered A&B \$2.2M for the 397 acre tract. A&B requested time to evaluate the offer and would discuss it at their April 25, 1985, board election (the company was undergoing an internal power struggle). On May 30, A&B informed the FWS that they were not interested in selling. Bob Sasaki, A&B's vice president, informed PIA Marmelstein that their reasons for not selling had to do with their sugar operations on lands surrounding Kealia Pond, the potential restrictive measures the FWS may enforce which would impact their operation, and A&B's long-term development plans for Kealia. Up to this point, The Nature Conservancy (TNC), specifically Kelvin Taketa, Hawaii's director, had been serving as a broker and mediator between FWS and A&B. Kelvin has a good relationship with Bob Sasaki, which aided communication efforts.

The FWS's only remaining alternative was condemnation. A&B was not interested in entering into friendly condemnation proceedings. TNC dropped out of the picture since they would not be needed in the proceedings. The RO-ACQ team and the Regional Solicitor's Office had formulated the condemnation; however, their heavy workloads and Washington Office (SOL) review had slowed the process. By year's end, the refuge was still waiting for the condemnation request to be sent to Washington (Justice Department) from the Regional Solicitor's Office.

On August 2, Ducret (RO-ACQ), Leinecke, Krakowski, and a representative of R.M. Towill and Associates (survey contractor) visited Kealia Pond, Maui, to find previously established survey points and discuss future boundary survey work to be completed for the FWS.

### 3. Other

Midway Atoll, under the administration of the United States Navy as an Naval Air Facility, has always been recognized as an important atoll for wildlife including migratory birds, monk seals, and green sea turtles. In July 1972, a Cooperative Agreement between the Service and the U.S. Navy was signed. The agreement provided for the conservation and management of fish and wildlife on the island. In 1985, an updated cooperative agreement was put into effect.

Since 1978, the Service has been investigating the possibilities of refuge overlay status for the atoll. There was an initial delay as results of the Tripartite Study were completed and boundary issues clarified. In 1984, the Service completed a wildlife management plan for the atoll, while the Navy expressed desires to manage the wildlife at the atoll.

In 1985 the Midway Overlay NWR proposal was still under consideration by various Navy offices, but no formal response to the proposal had been received by FWS. However, several meetings of Refuge staff and staff of the Pacific Division, Naval Facilities Engineering Command were held, and PIA Marmelstein met with Captain Harry Robins, Commanding Officer of Barbers Point Naval Air Station (NAS) and Midway Island to further discuss and detail this proposal. At years end, the refuge staff remain optimistic that this issue will be resolved in the near future.

Dick Moore (RO-ACQ) met with RWR staff in April to discuss realty issues on the wetland refuges.

In May, PIA Marmelstein, Peter Stine (FWS-ES), and refuge staff met with land managers of Bishop Estate (Oahu) to discuss possible exchange, sale, or lease of Estate lands to the FWS. Refuge Manager Krakowski presented a slide program

on FWS management of NWR wetlands in Hawaii. The Estate initiated the meeting to discuss Opaëula and Waimanu areas on Hawaii. However, much of the discussion centered around an area of Bishop Estate's immediate concern, Ukoa Marsh on the island of Oahu. The FWS expressed a desire to protect Opaëula and Ukoa Marshes, as the two wetlands are listed as primary areas in Hawaii's Waterbird Recovery Plan. The meeting was cordial and both sides agreed that continued communication was important.

#### D. PLANNING

##### 1. Master Plan

A draft Hawaiian Wetland Refuges Master Plan was completed in 1983. After review and establishment of new guidelines, a revised draft was initiated in 1985. In October, Krakowski started coordination with Paul Camp (RO-EN) on the revised plan. A condensed and updated revision of the initial draft document was still being worked on by year's end.

The formal initiation of the Hawaiian Islands NWR Master Plan/Environmental Impact Statement occurred in May 1983. A draft document was completed and public hearings were held in 1984. In 1985, the document continued to be reviewed and Section 7 Consultation was initiated with the National Marine Fisheries Service. (See the Hawaiian Islands NWR individual narrative for more information.)

##### 5. Research and Investigations

A variety of research and investigations are carried out on Refuge lands throughout the complex. The individual refuge sections of this report detail the studies conducted on those units and should be referred to for details.

Research entitled "Management and Habitat Selection of Endangered Waterbirds in Hawaii" began in January 1985 in cooperation with the University of Missouri, Cooperative Wildlife Research Unit. Dr. Leigh Fredrickson is the Principle Investigator and Dr. Curtice Griffin is a co-Investigator. Drs. Fredrickson and Griffin, Mr. Fritz Reid, and Stephen Berendzen arrived in Hawaii in January to plan the initial phase of this project. The group toured wetland sites throughout the main Hawaiian Islands accompanied by Biologist Fefer and Refuge Manager (Wetlands) Krakowski. The research is designed to provide recommendations for managing wetland sites throughout the State for endangered waterbirds. (More details on this project are included in

the James Campbell NWR section of this report.) As a result of the islands-wide survey conducted in January, it was decided to concentrate research at James Campbell NWR.

## 6. Other

An ADP plan was drafted by Biologist Fefer. After review by IRM, Region 1, it was implemented given availability of funds. As a result, RWR replaced its Superbrain computers with the purchase of IBM-compatible personal computers with 16 bit processors, printers and modems. A variety of software was also purchased at this time. These computers were not received until early 1986. Computers have proved very valuable to the refuge office in recent years. Primary uses include biological data analysis, budgeting, and word processing. Many additional uses are anticipated.

## E. ADMINISTRATION

### 1. Personnel

| FY | C/S | Permanent |           | Temporary | Total |
|----|-----|-----------|-----------|-----------|-------|
|    |     | Full-time | Part-time |           |       |
| 83 | 1   | 10        | 2         | 7         | 20    |
| 84 | 1   | 11        | 2         | 7         | 21    |
| 85 | 1   | 13        | 1         | 6         | 21    |

The following is a breakout of the personnel actions taken during the 1985 calendar year and a short narrative on key actions:

Larry Martin, from Arctic NWR, was selected in January for the Tern Island Assistant Refuge Manager GS-7 position vacated when Bernie Good transferred to Santee NWR in South Carolina. He transferred on a temporary appointment; later in the year he was converted to a full-time employee.

Steve and Gale Fairaizl departed Tern Island for the last time on January 21. Steve, who served as an Assistant Refuge Manager GS-9, accepted a position with ADC in Reno, Nevada. Gale also worked on Tern Island as a Biological Aid GS-3.

Effective January 20, Kilauea Point NWR Clerk-typist Noreen Bautista increased her part-time duty hours from 20 to 32 hours per week to cope with the increased administrative workload at that station.

In February, Richard Vetter, Refuge Biologist, BLM-Idaho, was selected to fill the Assistant Refuge Manager GS-9 position vacated by Steve Fairaizl.

On March 7, Duane Kenneth McDermond was selected to fill the Biological Technician GS-5 position vacated by Bruce Eilerts. On December 22, Ken was reassigned to Biological Technician, replacing Tim Ohashi.

Tim Ohashi was hired as a temporary Biological Aid on March 18 and then selected as a permanent full-time Wildlife Biologist GS-7 on April 15.

On March 18, Edward Bean was selected as a temporary Biological Aid GS-3. This appointment was extended to one full year. Ed was reassigned to a temporary Biological Aid, GS-3, on December 22 and replaced Ken McDermond.

Stephen Berendzen accepted a Cooperative Education appointment with the FWS on April 1. He served as a Student Trainee - Wildlife Biologist GS-5 on the Hawaiian Islands Wetland Management Study under the direction of the University of Missouri Wildlife Cooperative Unit. On October 13, Stephen Berendzen was promoted and converted to Refuge Manager GS-7. The direct management of the Kauai wetland refuges were his main responsibilities.

Nancy Sautter, Clerk-typist GS-3, resigned on April 4 to move to the mainland with her husband.

Bruce Eilerts, Biological Technician GS-5, resigned on June 22 to accept a FWS Wildlife Inspector position in Honolulu.

Margaret Hardwick, temporary Clerk-typist GS-3, resigned on July 6 to accept a permanent position with the U.S. Coast Guard, Honolulu. She was replaced by Anne Robb on July 7.

On July 19, Audrey Newman terminated her Biological Aid GS-3 position in order to work full-time with The Nature Conservancy in Hawaii.

On July 30, Dr. William J. Cooke started work as a temporary Wildlife Biologist GS-9 on Johnston Atoll NWR. He is this station's first employee.

Anne Robb, temporary Clerk-typist GS-3, was converted to a full-time employee on October 1.

Darcy Hu, Wildlife Biologist GS-5, was promoted to GS-7 on December 12.

## 2. Youth Programs

Two non-residential YCC camps were held within the Hawaiian

Islands NWR complex in 1985. Kilauea Point NWR had six enrollees that were led by crew leader Kathy Valier. This camp was in operation from June 10 through August 2. Their work projects included fencing, weed control, landscaping, and building maintenance.

The Oahu wetland refuges YCC camp also had six enrollees; the camp ran from June 10 to August 3. David Smith was selected as crew leader. Their activities included: fence line maintenance, habitat improvement, along with building and equipment rehabilitation.

An additional two Oahu enrollees participated in the program at Tern Island NWR.

#### 4. Volunteer Programs

The volunteer program of the complex is involved in a variety of duties. Complex-wide, 123 volunteers contributed more than 9,000 hours to the refuge program. Volunteers participate in the Hawaiian Islands Refuge primarily through the biological program at Tern Island. Volunteer biologists provide almost year-round assistance to the Refuge Managers at Tern Island. The major numbers of volunteers are involved with the program at Kilauea Point NWR. Over one hundred volunteers provided 7,554 hours of service at Kilauea Point. More details on the volunteer program are included in the individual refuge discussions.

#### 5. Funding

The table on the following page summarizes funding for the refuge complex from 1983 through 1985:

#### 6. Safety

Quarterly safety meetings were held on the following dates:

1. February 19 - Defensive driving films were presented.
2. May 29 and 31 - Thirteen FWS employees attended CPR training sponsored by the American Red Cross.
3. June 11 - Fifteen employees attended a Red Cross-sponsored Basic First Aid course.
4. September 4 - Mary Heavey of the Veterans Administration gave a presentation on health services that are available through their organization.

Jim McNulty, Region Safety Officer, inspected the station during the month of February.

FUNDING FOR REFUGEE COMPLEX  
 (By Program)  
 1983 - 1985

| FY | Staff | 1210            | 1220 | 1230          | 1240 | 1400  | 1480 | 1520 | 1921           | 1994           | 2841          | TOTAL |
|----|-------|-----------------|------|---------------|------|-------|------|------|----------------|----------------|---------------|-------|
| 83 | 20    | 345.0           | 7.7  | 3.0           | 14.0 | 184.5 | --   | 18.8 | 22.0           | 3.0            | 4.5           | 602.4 |
| 84 | 21    | 574.0           | --   | 3.0           | --   | --    | 55.0 | 20.9 | --             | 7.8            | --            | 661.1 |
| 85 | 23    | (1260)<br>723.5 | --   | (1270)<br>3.0 | --   | --    | 93.5 | 18.2 | (1971)<br>59.3 | (2841)<br>16.0 | (8610)<br>3.1 | 916.6 |

## 7. Technical Assistance

Refuges and Wildlife Resources staff played a substantial technical assistance role during 1985. Technical assistance on off-refuge lands and waters was provided to military installations, state agencies, and private citizens. Technical assistance to military installations focused on sites with the highest priority resource problems/opportunities. Technical assistance to FWS Ecological Services (Honolulu) was provided on request in the form of input and review to Corps permit applications, environmental impact statements, and other documents.

Principal areas of technical assistance are summarized below:

Midway - In 1985, wildlife biologists from the FWS continued to provide technical assistance to Naval Air Facility Midway (NAFMIDWAY) and traveled to Midway several times during the year for this purpose.. Migratory Bird Permits involving construction projects on Midway Island and reporting involved with these permits continues to be a major area requiring technical assistance at Midway.

A runway re-surfacing project was planned for Sand Island, Midway, for the late-July early-November time period based on FWS concerns for albatross nesting in the area. However, due to delays in navy contracting, the project was to occur in November through March, the period intended to be avoided. As a result, the Navy provided FWS with funding for discouraging albatross nesting in the runway apron areas. FWS biologists traveled to Midway Island in November to conduct this work. Fortunately, the numbers of albatross using the critical construction areas were minimal and the re-surfacing project could continue with minimum effect on these birds.

Other technical assistance provided at Midway during 1985 included investigations of disease or die-offs involving Laysan albatross and white terns. Several birds were found convulsing and dead by Midway staff in an area of Sand Island. Specimens diagnosed at the National Wildlife Health Lab (NWHL) revealed that these birds had crushed skulls, cause undetermined, but suspected. During a visit to Midway in November, many juvenile white terns were found in a moribund condition throughout Sand Island. The NAFMIDWAY staff informed the biologists that this had been occurring for several months and that several hundred white terns had died. Specimens were diagnosed by the NWHL as having died due to starvation. Apparently, feeding conditions in the vicinity of Midway Island were not optimum during the white tern chick growing period. It should be noted that the population of breeding white terns at Midway Islands has been increasing greatly in recent years and this apparent die-off may be the result of the population having reached

the carrying capacity for the area's available food resource. Continued monitoring of the white tern population at Midway may clarify this in future years.

Kaneohe Marine Corps Air Station (KMACS) - Provided a variety of technical assistance, from analysis and recommendations involving bird-airstrike hazards to field surveys of endangered species. Technical assistance included input concerning the management of the red-footed booby colony. Also provided assistance in field data collection in the program to monitor the effects of the November 1984 dredging project on the endangered Hawaiian stilt population at Nuupia Ponds. Provided technical review of products provided to KMACS by contractors involved with monitoring the physical, chemical, and biological changes to Nuupia Ponds from the dredging project. Provided input on moat construction and placement of training equipment in areas adjacent to Nuupia Ponds. Continued to serve on Tri-Agency committee on the management of the Nuupia Ponds Wildlife Management Area.

Pacific Missile Range (PMR), Kauai - Laysan albatross populations at PMR were monitored. Recommendations were provided to discourage Laysan albatross nesting in proximity to the runway. Three Laysan albatross chicks that hatched in the area adjacent to the runway were moved to Sea Life Park, Oahu, where they were to be allowed to fledge after being hand fed for several months. One of these chicks survived to fledging. A Cooperative Agreement for the Management of Wildlife Resources at PMR was signed during 1985.

Northwestern Hawaiian Islands - Provided resource data, logistical support, and field camp assistance to a variety of researchers from numerous agencies.

Statewide - Conducted statewide semi-annual counts and stilt recruitment surveys in coordination with State biologists. Cooperated with State biologists on study and recommendations for controlling depredations on prawns by black-crowned night herons at Amorient Farms, Oahu, and Orcas Farms, Molokai. Also coordinated with State biologists and State Department of Transportation on egret control at General Lyman Field, Hilo. Animal Damage Control Biologist G. Oldenberg travelled to Oahu, Maui, Hawaii, and Kauai during November to evaluate and provide recommendations to Federal and State biologists regarding bird-airstrike hazards and crop depredations.

Sea Life Park - Coordinated issuance of a migratory bird permit for collection/display for migratory seabirds.

Coordinated development of natural seabird exhibit at the Park. Coordinated seabird banding program for seabird exhibit and provided instruction on banding techniques to park personnel. Also included development of a remote islands area to include seabirds representative of the Hawaiian Islands NWR. Assistance on habitat requirements was provided.

#### 8. Other

Jim Sisson and Jack Donahue (RO-PM) were in Hawaii for a FWS personnel review March 11 through 15. They interviewed most of the personnel and all of the supervisors. They visited the Kauai staff and refuges on March 13, 1985.

Noreen Bautista, Kilauea Point NWR Clerk-typist, attended an OPM "File Management" course in Honolulu, March 26 and 27.

Refuge Manager Wass attended the Basic Refuge Academy in Blair, Nebraska, in April.

Refuge Manager Krakowski attended a Wetland Invertebrate Workshop at Turnbull NWR on April 24 and 25. This was followed by administrative training within the Portland FWS Regional Office from April 29 to May 10.

Biologist Fefer attended the Pacific Seabird Group Annual Meeting in San Francisco, California, in December. Fefer served as Hawaii Regional Representative to PSG and serves on the Executive Committee.

Biologist Fefer was temporarily assigned to the Alaska Maritime NWR during July. Fefer travelled to the Pribilof Islands to assist Maritime Refuge staff in monitoring seabird populations.

### F. HABITAT MANAGEMENT

#### 2. Wetlands

Honolulu RWR staff attended a Wetlands Management Workshop dealing with moist-soil plant management and the value of invertebrates on January 18. Leigh Fredrickson and Fritz Reid of the University of Missouri chaired the workshop.

On April 2, RWR staff met with Kuilima Development consultants and advised on mitigation measures to be used at Punahoolapa Marsh. The staff advised against building high islands and creating spoil banks along marsh channels.

On April 17, Moore (RO-ACQ) and Krakowski met with Maui County officials to discuss their proposed fish aquaculture site at Kealia Pond.

Krakowski, Ohashi, and Andy Yuen (FWS-ES) met with representatives of the Corps of Engineers and Waterfront Manor Development consultants on June 18. The landscape architect for the project requested aid on wildlife plantings and island construction for a two acre wetland mitigation project.

On July 18, RWR staff again met to discuss management at Waterfront Manor.

Krakowski, Woodside, and Yuen reviewed the proposed expansion of the watercress farm adjacent to the Waiawa Unit of Pearl Harbor NWR. Additional personnel from National Marine Fisheries Service and Army Corps of Engineers also participated in the review. A wetland mitigation area was agreed upon.

#### G. WILDLIFE

This category is covered in detail in each of the attached Refuge reports. Information included in this category for the Complex report involve wildlife that is found both on and off refuge lands that is part of the Complex program.

##### 2. Endangered and/or Threatened Species

A short-tailed albatross, an endangered species, was sited on Sand Island, Midway, during visits to Midway in January and November 1985. This bird was, therefore, on the island during two seasons, as albatross depart the nesting areas during the summer months. The bird was banded with a Japanese aluminum band on one leg and a plastic color marker on the other. Biologist Fefer wrote to Dr. H. Hasegawa of Toho University, Japan, as Dr. Hasegawa has been studying short-tailed albatross for many years. The bird at Midway was determined to be a nestling banded by Dr. Hasegawa on Torishima Island, Japan, in 1979. It was six years old when first sited on Midway. This was the first time the bird was seen since it fledged at Torishima in 1979. There are a total of 250 short-tailed albatross in the world. The only nesting area is Torishima Island, which is an active volcano in the western North Pacific. As Midway is part of the historic range for this species and short-tailed albatross occur at Midway, it may be prudent to consider a cross-fostering program of short-tails with black-footed or Laysan albatross at Midway as the Torishima population is

threatened by the active volcano. This could only be accomplished if predator problems at Midway were effectively controlled.

Kilauea Point staff were involved with Newell's shearwater aid stations to rehabilitate threatened shearwaters downed by lights on Kauai. Technical assistance was provided to Kauai Electric Company and to the Kauai Sheraton at Princeville concerning shading to reduce this problem.

Refuge staff participated in the State Department of Forestry and Wildlife's (DOFAW) semi-annual waterbird count on January 17 and July 30.

David Woodside, wetlands maintenance worker, assisted the State DOFAW in constructing an alala flocking pen at their Mauna Kea Field Station during the month of January.

Complex Manager Leinecke and Biologist Fefer coordinated with the National Park Service staff at Haleakala National Park and were briefed on forest management for endangered species at this Park.

#### 7. Other Migratory Birds

Biologist Fefer coordinated with Research staff involved with a proposal to study the effects and impacts of plastics on Hawaiian seabirds.

#### 15. Animal Control

On November 13, RWR staff consulted with Jim Keith (ADC-Research) in regards to his work on mongoose control on the island of Hawaii. Tentative plans were arranged to have Keith survey some of the wetland refuges to assess adaptability to control measures.

### H. PUBLIC USE

#### 1. General

In February, Dick Kuehner, Region I&R Specialist, and Chris Holden, Regional Artist, met with refuge staff to review existing I&R refuge programs and plan future I&R goals. RWR staff coordinated with these two frequently during the year on the production of a new refuge complex leaflet.

## 2. Law Enforcement

Refuge Manager Krakowski attended Law Enforcement Refresher Training in Sacramento, California, from March 4-8. Park Ranger Moriarty attended Law Enforcement Refresher Training in Sacramento during the April 1-5 session.

## 18. Cooperating Associations

This was the second year of operation for the Kilauea Point Natural History Association. The project can only be described as a complete success. The Association has extended the wildlife interpretive capabilities of Kilauea NWR through tours, newsletters, and other educational materials. It is a firmly established and viable organization thanks to the extra effort of the Kilauea Point NWR staff.

### I. EQUIPMENT AND FACILITIES

#### 1. New Construction

Bill Striplin and Ken Neuberger (RO-EN) were in Honolulu from March 19 through 22 to conduct interviews with prospective contractors bidding on major FWS construction projects in Hawaii. They reviewed current and future construction projects on Kauai and Oahu refuges on March 19 and 20, respectively.

Striplin (RO-EN) again visited the inhabited island refuges and reviewed upcoming construction projects in August. On August 21, he, along with Leinecke and Krakowski, met with personnel of the Oahu-based planning firm of Wilson Okamoto and Associates to discuss planning for future refuge construction projects.

#### 6. Computer Systems

The refuge had the use of a Digital Rainbow and two Superbrain II computers during the year. We have used these computers for data base management of biological data, word processing, and budgeting. The use of these computers has increased the productivity of the refuge staff and has become an important component of the complex program.

## J. OTHER ITEMS

### 1. Cooperative Programs

Cooperative programs were underway with State biologists involving the semi-annual statewide census of resident and migratory waterbirds. Cooperative programs with National Marine Fisheries Service focused on support for turtle and monk seal research in the Northwestern Hawaiian islands.

Kealia Pond - RWR staff and RO-ACQ drafted a Cooperative Agreement for the FWS and Maui County late in 1984. This Agreement would document arrangements verbally agreed upon concerning FWS's pending acquisition of Kealia Pond.

First, the Agreement would assure the County that FWS would reimburse the County of Maui \$175K for improvements (water wells, pumps, fish tanks, buildings, etc.) after FWS acquires Kealia Pond. These are improvements that the County of Maui had to purchase when they acquired the lease from Alexander and Baldwin (August 2, 1985). The County will be responsible for the care and maintenance of these improvements.

Second, the Agreement would assure FWS that the aquaculture operation would produce water of the quantity and quality desired by the FWS. The refuge plans to develop nesting habitat for endangered waterbirds north of the pond proper, in an area vegetated presently by Batis maritima. A series of impoundments is proposed, which would require at least a flow of 700 gpm to maintain water levels on 200 acres of impoundments. Stream flow into the pond is presently intermittent; in fact, the main pond dries up during the summer months. RWR has requested that the aquaculture's effluent be fresh or less than 5 ppt. This area historically has been seasonally flooded by fresh rainfalls or irrigation water from upland areas. Continual pumping of brackish or saline water into the pond would change the ecosystem. This is a concern, since brackish water shrimp production is now a money making venture in Hawaii.

Third, the agreement would limit the types of aquaculture. The County originally proposed to use the facility exclusively for the production of a freshwater top minnow, which would serve as bait for the Hawaii tuna fishery. This minnow requires a water system needing 80-100% exchange daily. The amount of water discharged from such management would greatly benefit the waterbirds in proposed impoundments and some can be used in the existing pond. However, as County planning for this facility proceeded, other types of aquaculture were suggested. Early in the year, the County revised its goals to commercial production and other types of research, as well as baitfish production. RWR staff have made it clear that certain exotic species may

cause extreme damage to the ecosystem if they escape. The Agreement requires that prior to the introduction of any new species, there must be a review by FWS, National Marine Fisheries Service, and the State of Hawaii.

Fourth, the Agreement pointed out that there may be an increase in waterbird use as a result of the refuge and the aquaculture facility. The FWS will lend expertise in development/operation of the aquafarm to reduce losses due to waterbirds. However, direct control or harassment will not be tolerated.

Bob Agres, the Maui County lead for this aquaculture development, has been very cooperative and was quite willing to meet these conditions. However, the Maui Corporation Counsel spent an inordinate amount of time reviewing the Agreement and held it past the August 2 purchase of the lease by the County. The RO-ACQ team no longer pushed for a signed Agreement after August 2.

Meetings through the year in regards to the aquafarm development were as follows:

On July 18, RWR staff met with Peter Boucher, University of Hawaii consulting engineer hired by the County of Maui to design the aquafarm. The discussion centered around water effluent quality, night heron depredation, and dike construction methods as a deterrence, and water quantity and quality needs by the FWS.

Krakowski and Leinecke met with David Charbonneau, an auditor with the Department of Commerce, on September 30. Mr. Charbonneau was investigating Maui County's spending of Economic Development Agency funding for baitfish research. RWR has been attempting to acquire Kealia Pond, Maui, part of which is the future site of Maui County's aquaculture facility. We informed Charbonneau of RWR's support for the future baitfish facility and our plans to acquire the Kealia Pond site as a wetland refuge.

On November 21, RWR staff again met with Peter Boucher. He was developing plans for Maui's baitfish facility at Kealia Pond. Mr. Boucher delivered an Environmental Impact Statement (EIS) on his proposed plans for the facility. RWR's formal comments were attached to the FWS-ES review of the EIS. A discussion followed on construction plans to deter black-crowned night herons, since the plan offered none. The RWR staff again restated the water quality and quantity standards required by the FWS.

#### 4. Credits

Most of the staff participated in some form or another in the production of this narrative. Refuge Manager Krakowski coordinated the completion of the narrative. Photo credits are indicated by photographer's initials, if the photographer is known.

HANAIEI NWR

Hanalei, Kauai, Hawaii

ANNUAL NARRATIVE REPORT

Calendar Year 1985

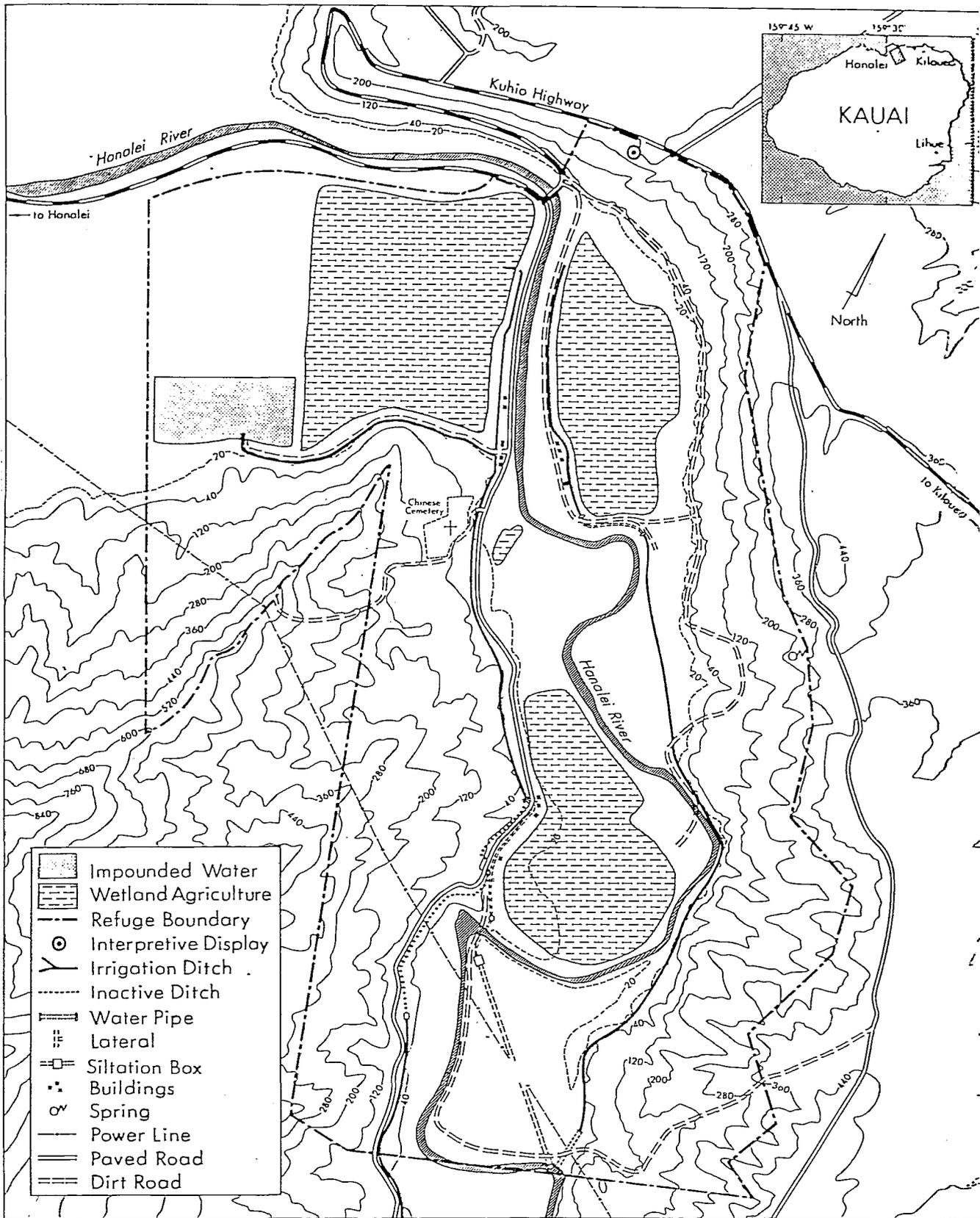
U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

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 100-200 acres of the refuge. This is an unmanned station that is administered by the staff at Kilauea Point NWR.



This view of Hanalei NWR is captured on film by thousands of tourists. The taro paddies are recognized easily. The refuge maintains an interpretive display at this location. RWR staff.



-  Impounded Water
-  Wetland Agriculture
-  Refuge Boundary
-  Interpretive Display
-  Irrigation Ditch
-  Inactive Ditch
-  Water Pipe
-  Lateral
-  Siltation Box
-  Buildings
-  Spring
-  Power Line
-  Paved Road
-  Dirt Road

0 1000 feet  
 0 300 m  
 NOTE: CONTOURS IN FEET

**HANALEI NATIONAL WILDLIFE REFUGE**  
 Hanalei, Island of Kauai, Hawaii

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service

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A. HIGHLIGHTS

Kilauea Point Park Ranger Moriarty was relieved of responsibility of Hanalei and Huleia NWR's in April. Management responsibility was put under direct control of the Wetlands Refuge Manager (Sec. E.1).

A house on Hanalei Refuge was purchased from previous permittee Matias Clarin for \$2,000 in September. Plans were made to renovate this house as a dwelling for an Assistant Refuge Manager who would be hired in October and stationed on Kauai. Inadequate funding did not allow renovation of the house or transfer of the Refuge Manager (Sec. C.3).

B. CLIMATIC CONDITIONS

Characteristic climatic conditions were present during CY85 with no major storms to report. Rainfall was less than typical throughout the year. 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.

## 1985 RAINFALL DATA FOR HANALEI NWR

| Month                 | Amount |
|-----------------------|--------|
| January               | 4.28   |
| February              | 6.30   |
| March                 | 5.82   |
| April                 | 3.89   |
| May                   | 4.24   |
| June                  | 1.82   |
| July                  | 5.60   |
| August                | 3.93   |
| September             | 3.47   |
| October               | 11.23  |
| November              | 3.85   |
| December              | 0.77   |
| Total Annual Rainfall | 55.20  |
| Mean Monthly Rainfall | 4.60   |

## C. LAND ACQUISITION

### 3. Other

A house on Hanalei Refuge, constructed prior to Federal ownership of this land, was purchased. Matias Clarin, who constructed the house and occupied it under Special Use Permit, signed a quit claim deed in September and was sent a check for \$2,000 in October. It was intended to renovate this house as a residence for a Refuge Manager who would be stationed on Kauai. Plans for renovation were delayed due to inadequate funding.



Funding for the Clarin house failed to materialize in 1985. SB

## D. PLANNING

### 2. Management Plan

A Sport Fishing Plan and Environmental Assessment of fishing impact on Hanalei Refuge was drafted in October.

#### 4. Compliance with Environmental Mandates

The Hoopulapula Haraguchi Rice Mill, a State of Hawaii and National Register of Historic Sites property, was dedicated in January with a formal Japanese topping-off ceremony. Several hundred people attended, and considerable press was generated by this event.

A Senate bill introduced by Kauai Senator Lehua Fernandes-Salling to fund \$25,000 for restoration of the interior of the Hoopulapula Haraguchi Rice Mill was killed in the last days of the legislative session in April.



The exterior of the Hoopulapula Rice Mill was completed in 1985. SB

#### 5. Research and Development

Nesting ecology was conducted with 14 moorhen nests, 1 coot nest, and 6 stilt nests found. Hatching success rates were low for both moorhen and stilt, with suspected causes being predation and flooding. The coot nest was the first documented record of coot reproduction on Kauai. The coot eggs were laid in an old moorhen nest and were successfully hatched.

## E. ADMINISTRATION

### 1. Personnel

On April 19, an administrative reorganization was implemented. Refuge Manager (Wetlands) Krakowski's position was reorganized to allow more staff attention to potential new acquisitions at Kealia Pond and Opaepa. Kilauea Park Ranger Moriarty was relieved of responsibilities at Hanalei and Huleia NWR's to concentrate on I&R activities at Kilauea Point and other areas as directed by Refuge Complex Manager Leinecke.

In October, Steve Berendzen was hired as Refuge Manager (Wetlands) to be stationed on Hanalei NWR and to manage Hanalei and Huleia Refuges. However, inadequate funding prevented renovation of a refuge house, and the Refuge Manager remained at the Honolulu office.

### 2. Youth Programs

A YCC group from Kilauea Point, under the supervision of Kilauea Point Maintenance Worker Bottomley, undertook and completed two small jobs at Hanalei Refuge in July.

A ditch leading to the habitat impoundment had been obstructed by dirt and rock that had sloughed off the adjacent hillside. This material and vegetation was removed along a large portion of this ditch, allowing water to flow into the impoundment.

The YCC crew and leader also grouted loose rocks around the intake of the 48-inch pipe, providing water to the impoundment and taro farmers on the west side of the river.

### 6. Safety

Regular safety meetings were conducted by Kilauea Point staff and volunteers. Unsafe and hazardous conditions were noted and corrective actions taken.

### 7. Technical Assistance

Dick Kuehner, Regional I&R Specialist, visited Hanalei NWR in February and reviewed existing I&R plans and discussed future options with staff.

On April 18, Supervisory Realty Specialist Dick Moore met with Hanalei Residential Permittee Clarin to discuss relocation expenses and possible reimbursement for a dwelling he constructed at Hanalei NWR.

Senior Realty Specialist Scott Wise sent information requested by Wetlands Refuge Manager Krakowski regarding ownership of dwellings and other improvements on Hanalei Refuge. However, this question was never completely answered and an ongoing investigation continues.

#### 8. Other Items

On March 8, a refuge revenue sharing check for \$14,459 was presented to Kauai Mayor Kunimura by PIA Marmelstein and Park Ranger Moriarty. The amount was based on .75% of the appraised land value of Hanalei and Huleia NWR's.

On April 18, Complex Refuge Manager Leinecke, Refuge Manager (Wetlands) Krakowski, Dick Moore, and Park Ranger Moriarty met with Flora Mateo and her husband, Mal Quick, to discuss options for reconstruction of a residence they seek to build on Hanalei Refuge. They were reminded that modifications had to comply with Refuge specifications. Mateo was also instructed to have the building comply with county building codes and to obtain a permit.

In September, refuge staff considered a request from taro farmer Rodney Haraguchi to convert a storage building into an office with shower/toilet facilities and an additional cesspool. The request for an additional cesspool was denied; however, authorization was granted to modify the building and use it as an office.

In 1982, the Hanalei Agricultural Park Cooperative Agreement was established between the State of Hawaii and the FWS. The agreement was designed to expand taro farming on Hanalei NWR. Since that time, however, the status of taro and refuge management perspectives have changed. The taro market continues to be unstable. The addition of more taro farming may collapse a market already over-supplied. Taro land has been found not to provide all of the habitat needs of Hawaii's four endangered waterbirds. Increasing taro farming land may restrict other management alternatives (refuge-managed impoundments) that could provide these habitat needs. The agreement was initiated to provide mutual funding for the enhancement of the refuge taro irrigation system. Since that time, the FWS provided \$2 million of BLHP funds that have financed most of the proposed taro irrigation system enhancement. Due to these factors, the Hanalei Agricultural Park Agreement was mutually dissolved in June, 1985.

## 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.

### 2. Wetlands

The 20 acre impoundment is choked with California grass that covers 95 percent of the surface area. Small patches of bulrush are present, and water lillies have invaded the little patches of open water.



California grass continues to choke the 20 acre wetland impoundment. SB

#### 4. Croplands

The Alapai permit was terminated in April because Mrs. Alapai was unable to continue farming taro. Permittees Watari and Spencer indicated interest in farming the Alapai parcel. Spencer has priority for the parcel as an adjacent farmer.

In April, Mr. Tai Hook requested expansion of his taro permit into his adjacent pastoral permit. Mr. Tai Hook was told that we did not intend to expand taro in the face of an apparent decline in demand. We have also designated the Tai Hook pasture areas as ideal for impoundments should we have funds to develop them.

Mr. Tai Hook again requested more land in May and cited Haleiwa Poi Company as needing more taro. Refuge Manager (Wetlands) Krakowski called Haleiwa Poi Company, who explained the seasonal fluctuation in demand, and indicated that an increase in production during summer would result in a glut during winter. This information was then transferred to Mr. Tai Hook along with a denial for more taro land.



Taro is a wetland plant that requires a steady supply of water. RWR staff photo

A past permittee, Nemecio Villanueva, requested a permit for taro farming land. When Mr. Villanueva attempted to farm in 1981, he lacked capital to begin and had problems with

adjacent permittees. Considering previous problems and low demand for taro, no permit was issued.

#### 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). All three permittees verbally requested more pasture area, but requests were denied due to poor compliance with permit conditions. The total Animal Unit Months grazed on Hanalei is approximately 2,000 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 cattle which escape fenced areas and damage crops, irrigation structures, or endangered waterbird nests.

#### 10. Pest Control

Dogs and cats appear to be the worst predators of endangered waterbirds on Kauai. Seven cats were trapped throughout the year by Kilauea Point Maintenance Worker Bottomley, and four of these were trapped during the peak of the moorhen and stilt nesting season in April.

Wild chickens or "jungle fowl" cause problems to taro by pecking holes in taro corms, allowing invasion of bacteria and fungus that rot the corm. Wild chickens were occasionally shot by Bottomley when dense numbers were observed.



Wild chickens or "jungle fowl" have caused problems for the refuge taro farmers. SB

#### 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 determined the proportion of birds visible from counts relative to the actual population. 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 apparently is diurnal movement, perhaps to mountain streams off the refuge during days, but back to safe roosting areas (like the refuge) during the night. Also, birds tend not to form large flocks, 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 17 to 92 birds. No nests were reported during 1985, but one brood was observed.

Hawaiian moorhen: Moorhens are relatively secretive and, therefore, difficult to count. The peak count was 29, and average counts were about 20. Fourteen nesting attempts were documented in 1985 in the dense taro patches. Five nests appeared successful at hatching, but few young fledged. Flooding, predation, and abandonment were predominant causes of nest failure. Peak nesting occurred in April.

Hawaiian coot: In wet periods, this species apparently moves from Kauai to Niihau Island (30 km. to the west) where ephemeral habitats are usually flooded by winter rains. In wet winters, the species remains at Niihau until the wetlands dry up. During the mild year of 1985, the coot population was variable and ranged from 15 to 163 with no obvious seasonal trends. The first documented coot nest on Kauai was recorded in April. Two chicks hatched from three eggs in an old moorhen nest.

Hawaiian stilt: Like the coot, the stilt is believed to migrate to Niihau during wet periods. The winter population was low and sometimes no stilts were seen. Up to 36 stilts were observed during summer and fall. Nesting at Hanalei is restricted to narrow dikes between taro fields. Six stilt nests were located, with the majority found in April and May. Two nests hatched successfully, and the others were predated or flooded.

### 3. Waterfowl

In addition to the native Hawaiian duck, an incidental sighting of a blue-winged teal was made in December.



The taro fields provide good habitat for Hawaii's endangered moorhen. SB



The Hawaiian duck or "koloa" has the appearance of a drab mallard. SB

#### 4. Marsh and Waterbirds

Black-crowned night herons occurred regularly on the refuge, and counts averaged 10 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 an 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. An average of approximately 10 birds was seen in 1985.

#### 5. Shorebirds, Gulls, Terns, and Allied Species

Lesser golden plovers winter on Hanalei NWR, with numbers averaging 9 birds. Wandering tattlers are also occasionally seen in open taro ponds.

#### 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 the estuary areas where spawning occurs. The other species of o'opu are

believed to spawn year-round at any location of the river.

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. Couret's paper indicates that 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

### 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 429,420 people viewed the refuge and had access to interpretive panels in 1985.

### 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.

## 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 permittees Flora Mateo and Mr. and Mrs. Mike Fitzgerald continued construction and renovation of dwellings on their permits. Construction by Mateo has 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. Removal of this material allowed water to flow unimpeded into the impoundment.

Loose rocks around the intake of the 48" pipe were grouted to stabilize this structure. The 48" pipe carries water to the 20 acre impoundment and to taro farms on the west side of Hanalei River.

### J. OTHER ITEMS

#### 1. Cooperative Programs

On January 23, a group of mainland and Hawaii Biologists with interests in wetland management visited the Kauai wetland refuges and several prominent wetlands on Kauai. The trip was intended to acquaint the group with the present status of Hawaii wetlands in preparation for a more detailed study designed to improve wetland management practices on National Wildlife Refuges in Hawaii.

## 2. Other Economic Uses

Kilauea Point Park Ranger Moriarty reviewed "Administration of Specialized Use" in the Draft Refuge Manual and justified fees charged to taro farmers by special use condition requirements.

University of Hawaii researcher Dr. Ramon Dela Pena is studying different varieties of taro and is trying 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. Taro leaves are also eaten and used as traditional wrappings for some foods.



Taro Special Use Permit farm housing ranges from the Haraguchi home site. SB



To the Walter Koga worker residence. SB

3. Items of Interest

Hanalei files from the Regional Engineering Program were sent to this office for disposition. Some items in the files were of historical value for our reference files.

4. Credits

Steve Berendzen wrote this narrative.

HULEIA NWR  
Kauai, Hawaii

ANNUAL NARRATIVE REPORT  
Calendar Year 1985

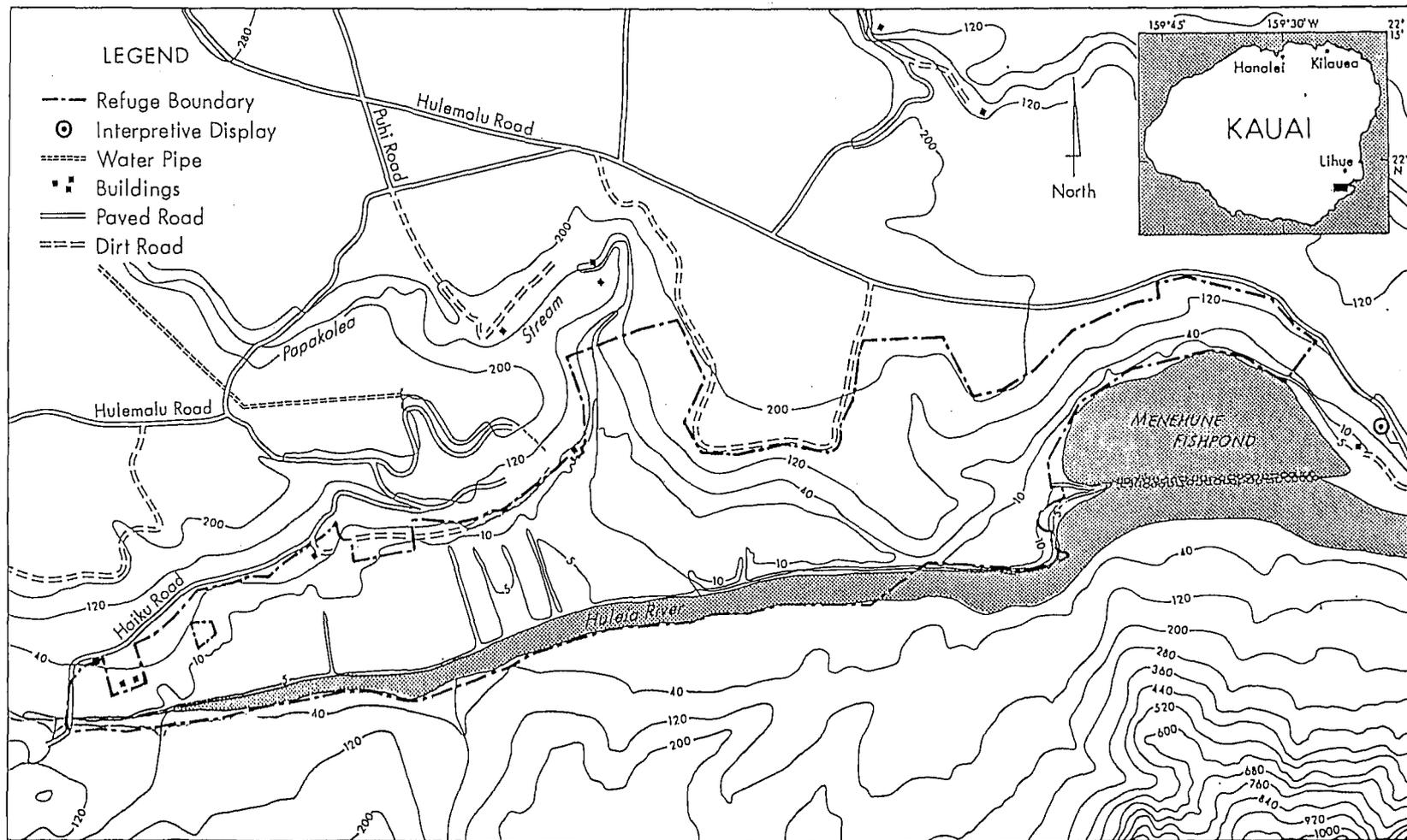
U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

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 the staff at Kilauea Point NWR. Waterbird use is limited due to the restricted number of wetland areas on the refuge. However, wetland development plans, which rank high in the region, could dramatically increase waterbird use and production.



Huleia NWR lies to the north (left) of Huleia Stream. RWR slide file.



0 1000 feet  
 0 300 m  
 NOTE: CONTOURS IN FEET

**HULEIA NATIONAL WILDLIFE REFUGE**  
 Huleia, Island of Kauai, Hawaii

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service

HULEIA NATIONAL WILDLIFE REFUGE

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K. FEEDBACK

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A. HIGHLIGHTS

A marijuana growing operation was discovered on Huleia NWR by the Kauai Police Department on September 25. One suspect was taken into custody and a truckload of marijuana was seized.

On the following day, all equipment and materials were removed from the encampment and detained as evidence. The campsite and cultivated area were returned to their pristine state (Sec. H.17).

Purchase of Kanoho property was transacted on December 12 (Sec. C.1).

B. CLIMATIC CONDITIONS

No major storms occurred during 1985 and rainfall was lower than normal throughout the year. Weather data recorded at Lihue Airport is most representative of Huleia Refuge.

## 1985 RAINFALL AND TEMPERATURE DATA FOR HULEIA NWR

| Month.                   | Rainfall | Average Daily Temperatures |      |
|--------------------------|----------|----------------------------|------|
|                          |          | Low                        | High |
| January                  | 3.47     | 63.2                       | 78.2 |
| February                 | 8.52     | 67.4                       | 78.2 |
| March                    | 2.67     | 69.5                       | 77.5 |
| April                    | 3.89     | 67.5                       | 78.2 |
| May                      | 2.14     | 69.7                       | 79.9 |
| June                     | 1.51     | 72.0                       | 83.3 |
| July                     | 1.77     | 74.8                       | 84.9 |
| August                   | 2.30     | 74.8                       | 85.0 |
| September                | 5.24     | 13.2                       | 84.6 |
| October                  | 5.24     | 72.6                       | 82.1 |
| November                 | 4.71     | 66.7                       | 80.2 |
| December                 | 0.67     | 65.0                       | 79.0 |
| <hr/>                    |          |                            |      |
| TOTAL ANNUAL<br>RAINFALL | 42.13    |                            |      |
| MEAN MONTHLY<br>RAINFALL | 3.51     |                            |      |

## C. LAND ACQUISITION

### 1.- Fee Title

Henry Kanoho, property owner adjacent to Huleia NWR, died June 10, 1985. Mr. Kanoho is survived by 12 children, who are heirs of his estate.

Scott Wise, Senior Realty Specialist, informed refuge staff that a property transfer had been made with the Kahono heirs. On December 12, titles were transferred and recorded so that the Fish and Wildlife Service acquired Exclusion 9 (3.9 acres) and gave the Kanoho heirs 1.3 acres of land around the Kanoho residence.

The Ching exchange (Exclusions 5, 6, and 7) remains as the last parcel within Huleia NWR targeted for acquisition. This is an important parcel for acquisition because the lower portion of it is located in wetlands planned as endangered waterbird management units. The Exchange is owned by a large kuleana (60+ people). A transfer requires consent of all owners; an attempt at transfer failed in 1980. Wise (RO-ACQ) has kept in touch with many of the owners to let them know that the FWS is still interested in the properties and to determine whether any of the dissenters had changed their minds.

## D. PLANNING

### 5. Research and Investigation

A waterbird population census was conducted to provide information on waterbird usage of the limited wetland habitat on this area.

## E. ADMINISTRATION

### 1. Personnel

On April 19, an administrative reorganization was implemented. Refuge Manager (Wetlands) Krakowski's position was reorganized to allow more staff attention to potential new acquisitions at Kealia Pond and Opaeula.

Kilauea Park Ranger Moriarty was relieved of responsibilities at Hanalei and Huleia NWR's to concentrate

on I&R activities at Kilauea Point and other areas as directed by Refuge Complex Manager Leinecke.

In October, Steve Berendzen was hired as Refuge Manager (Wetlands) to be stationed on Hanalei NWR and to manage Hanalei and Huleia refuges. Inadequate funding prevented renovation of a refuge house, however, and the Refuge Manager remained at the Honolulu office.

## 6. Safety

Regular safety meetings were conducted by Kilauea Point staff and volunteers. Unsafe and hazardous conditions were noted and corrective actions were taken.

## 7. Technical Assistance

On March 8, a refuge revenue sharing check for \$14,459 was presented to Kauai Mayor Kunimura by Marmelstein and Moriarty. This amount was based upon .75% of the appraised land value of Huleia and Hanalei NWR.

# 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 drainage canal and seasonally flooded lowlands provide only marginal wetland habitat.

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

## 7. Grazing

Grazing permittee Lara had a total of 513 AUM's for the 158 acre grazing area. He was charged \$1.25 per AUM. Lara has been actively controlling noxious vegetation in the grazing permit area.

The dry summer and fall months allowed cattle to graze low lying areas that would provide good seasonal waterbird habitat when winter rains begin.



Pluchea indica is a problem shrub growing in the lowlands of Huleia NWR. RWR slide file.

## 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 four 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 an important endangered waterbird habitat.

### 4. Marsh and Waterbirds

An average population of 20 cattle egrets (introduced) were observed on the refuge during 1985.

## 6. Raptors

Infrequent sightings of an osprey near Huleia River and Menehune Fishpond were reported to Kilauea Point staff during 1985.

## 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. A portion of Huleia Refuge can also be observed from this location. It was estimated that approximately 24,747 people stopped at this overlook to view the fishpond and refuge in 1985.

### 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 8,519 kayakers passed through the refuge in 1985.

Kayak use has increased somewhat from the past year, and it is felt that other river traffic has increased considerably.

### 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.

### 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 visitors, and much air traffic passes through Huleia Valley over the refuge.

## 17. Law Enforcement

On September 25, 1985, Kilauea Point Park Ranger Moriarty was notified of a marijuana growing operation on Huleia NWR by the Kauai Police Department. Moriarty immediately went to Huleia Refuge and observed the site of the growing operation.

A Mr. Dean Epperly had been taken into custody and Kauai Police felt that another suspect was still free. A diary indicated that assistance was provided to the growers by other individuals, possibly residents of the local community.

Kauai Police officers had seized a truckload of marijuana from the growing site and also confiscated other evidence including a detailed diary, a powerful bow, and marijuana paraphenalia.

Detailed pictures had also been taken of the marijuana and the site.

On the following day, Moriarty and Kilauea Point Maintenanceworker Bottomley returned to the site and removed all remaining camping gear and personal items. All remaining trash and rubbish was removed to return the site to the pristine state expected on a National Wildlife Refuge.

The seized items and trash were taken to the Hanalei dump, and items of no value were photographed and discarded. All items were inventoried and valuable items were retained as evidence.

## J. OTHER ITEMS

### 1. Cooperative Programs

On January 23, a group of mainland and Hawaii Biologists with interests in wetland management visited the Kauai wetland refuges and several prominent wetlands on Kauai. The trip was intended to acquaint the group with the present status of Hawaii wetlands in preparation for a more detailed study designed to improve wetland management practices on National Wildlife Refuges in Hawaii.

### 2. Other Economic Uses

Kilauea Point Park Ranger Moriarty reviewed "Administration of Specialized Use" in the Draft Refuge Manual and determined that Special Use Permittee, Kauai River

Adventures, should pay fees for using and crossing the refuge in their profitable endeavors.

4. Credits

Steve Berendzen wrote this narrative.

JAMES CAMPBELL NWR  
Kahuku, Oahu, Hawaii

ANNUAL NARRATIVE REPORT  
Calendar Year 1985

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

## INTRODUCTION

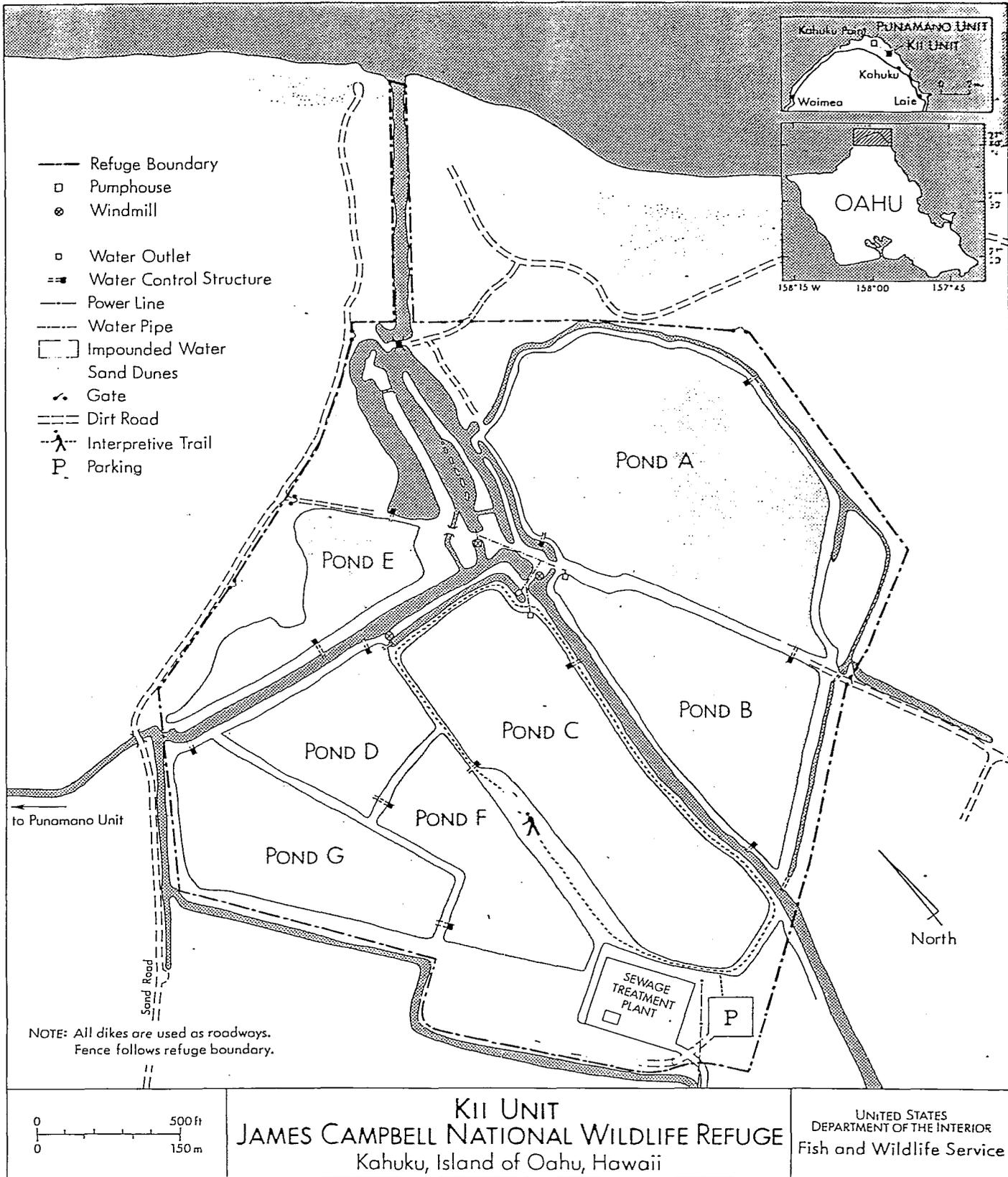
The James Campbell National Wildlife Refuge consists of 145 acres of wetland habitat in two units near the community of Kahuku on the northeastern shore of Oahu, Hawaii. The Punamano Pond Unit (37.5 acres) is a naturally occurring, spring-fed marsh, while the Kii Unit (107.5 acres) consists of man-made ponds formerly established in 1977 to provide habitat for Hawaii's four endangered waterbirds (stilt, coot, moorhen, and duck) and other native wildlife. After the closure of the Kahuku Sugar Mill resulted in the drying of the Kii settling ponds (formerly used extensively by waterbirds), the James Campbell NWR was established to return this wetland habitat to its former productivity. 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.

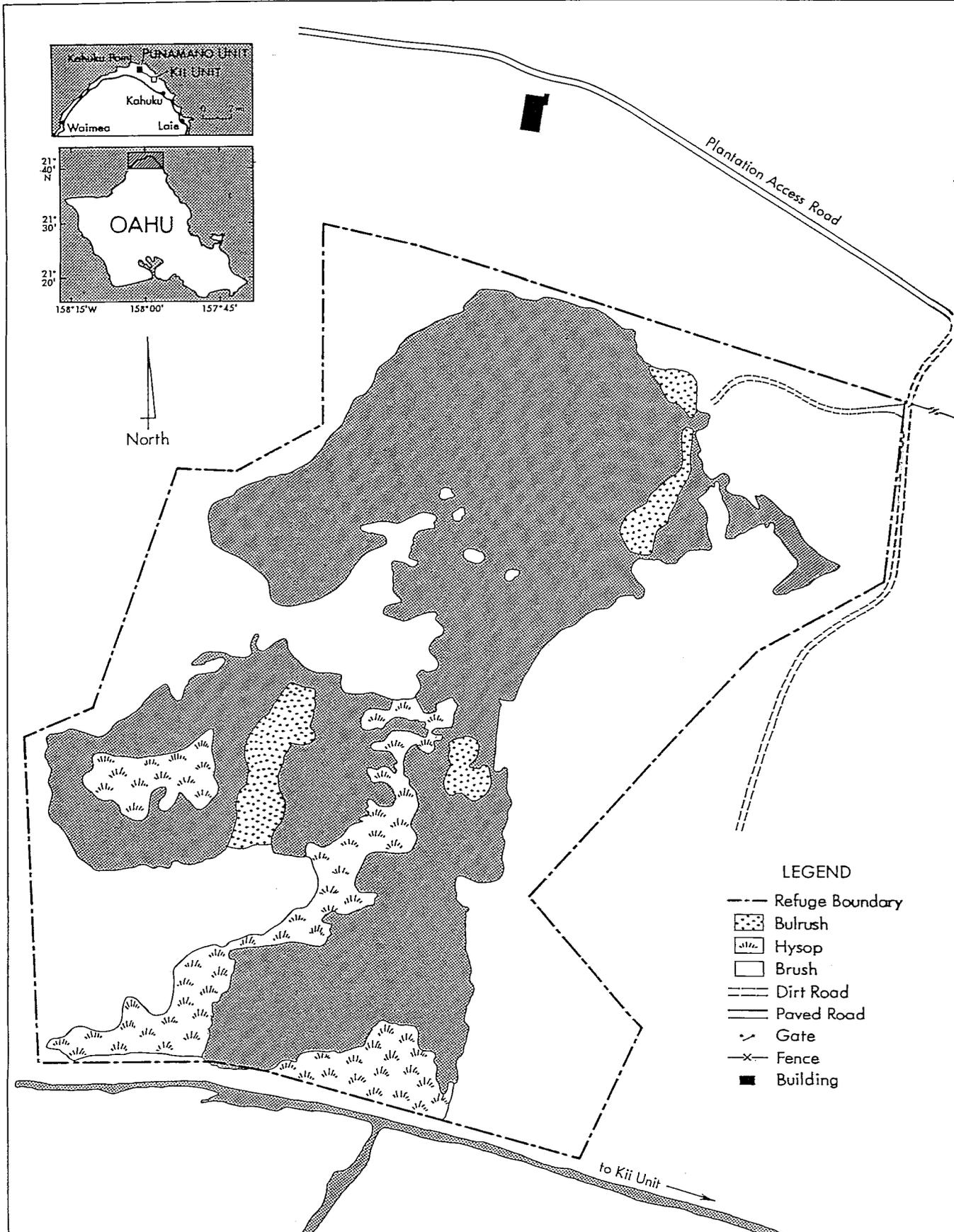
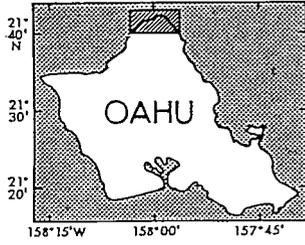
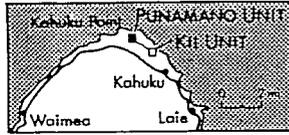


The Kii Unit of James Campbell NWR. A view of Pond A from the top of the 12' windmill looking "makai" (toward the ocean). DW



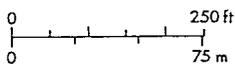
The Kii Unit of James Campbell NWR. A view of Pond C and F from the top of the 12' windmill looking "mauka" (toward the mountains). DW





LEGEND

- Refuge Boundary
- Bulrush
- Hysop
- Brush
- Dirt Road
- Paved Road
- Gate
- Fence
- Building



PUNAMANO UNIT  
 JAMES CAMPBELL NATIONAL WILDLIFE REFUGE  
 Kahuku, Island of Oahu, Hawaii

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service

JAMES CAMPBELL NATIONAL WILDLIFE REFUGE

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The Punamano Unit of James Campbell NWR--  
a natural spring-fed marsh. RJS

#### A. HIGHLIGHTS

1985 was the first year of the University of Missouri two-year field study of the waterbirds and wetlands of the Kii Unit (Sec. D.5). Hawaii Audubon Society adopted the Kii Unit on May 15 (Sec. E.4). The refuge coordinated with the Campbell Estate and the town of Kahuku on the planning and construction of emergency flood swales on the Kii Unit (Sec. F.1, I.1). Ron's Construction Company cleared the Punamano Ditch in September and October (Sec. F.10). A local prawn farmer proposed construction of a new aquaculture facility adjacent to the Kii Unit (Sec. F.11). Increases in Hawaiian duck numbers and waterbird nesting were noted at the Kii Unit (Sec. G.2). The refuge replaced the 40 and 5 hp. flood control pumps at the Kii Unit through emergency procurement action (Sec. I.4).

## B. CLIMATIC CONDITIONS

The nearest weather recording station, operated by Amorient Aquafarm, is adjacent to the refuge. The following station summary for January-December, 1985, reflects the climatic conditions at the refuge.

|      | Temp.<br>(Ave. max.) | Temp.<br>(Ave. min.) | Temp.<br>(Ave.) | Precip.<br>(in.) |
|------|----------------------|----------------------|-----------------|------------------|
| Jan. | 78.1                 | 67.8                 | 73.0            | 7.62             |
| Feb. | 77.6                 | 66.3                 | 72.0            | 9.21             |
| Mar. | 78.4                 | 69.3                 | 73.9            | 1.54             |
| Apr. | 79.3                 | 68.9                 | 74.1            | 1.60             |
| May  | Miss.                | Miss.                | Miss.           | 4.46             |
| June | 81.9                 | 72.1                 | 77.0            | 0.78             |
| July | 83.0                 | 73.4                 | 78.2            | 0.88             |
| Aug. | 83.6                 | 73.1                 | 78.4            | 1.02             |
| Sep. | 83.6                 | 72.5                 | 78.1            | 4.27             |
| Oct. | 82.0                 | 72.0                 | 77.0            | 4.50             |
| Nov. | 80.7                 | 66.7                 | 73.7            | 5.05             |
| Dec. | 78.7                 | 66.0                 | 72.4            | 0.39             |
|      |                      |                      | TOTAL PRECIP.   | <u>36.32</u>     |

Warmest recorded temp. 3/31/85; 88 degrees F.  
 Coldest recorded temp. 2/1/85; 50 degrees F.  
 Most precipitation in one day, 2/15/85; 3.1 inches.

Typical weather patterns occurred in 1985: northeasterly trade winds averaging 12-14 mph. blew throughout the year; kona weather, which results in reduced winds from the south and prolonged periods of wet weather, occurred during the winter and spring months.

## C. LAND ACQUISITION

### 2. Easements

None of the Punamano Unit boundary is fenced. A fence is needed to keep cattle, goats, and dogs out of the refuge. Most of the south, and portions of the west and north boundary, are under water. Because the refuge staff did not want to build the fence in water and thought that the Estate could not utilize the wet areas adjacent to the refuge, they coordinated with managers of Campbell Estate to secure a fenceline easement adjacent to the Punamano Unit. Estate

Land Manager, Jim Dybdal agreed to the fencing easement on the south side, but refused to allow a change in fencing on the west and north sides. He believes that the wet areas outside the present west and north boundaries were created after the refuge was established. Dybdal would like the refuge to lower water levels in the Kahuku Basin, which would reduce the water area of Punamano. Further discussion of this water management issue can be found in Section I.1. The refuge plans to build the fenceline in 1986.

### 3. Other

Refuge and Regional Office staff met with Campbell Estate representatives throughout the year to discuss an addition of 12 acres to the Kii lease. The parcel is wetland habitat located along the southern boundary of this unit. In December, R.M. Towill Corporation initiated a boundary survey of this addition.

Bob Ducret (RO-ACQ) visited the refuge on October 4. He reviewed areas that will soon be added to the Kii Unit lease and the proposed fence boundary of the Punamano Unit.

## D. PLANNING

### 1. Master Plan

A Draft Master Plan for the Hawaiian Wetlands National Wildlife Refuge Complex was submitted for Regional Office review in October.

### 3. Public Participation

In February, refuge and regional office personnel met with James Campbell Estate management personnel. The Estate was informed of our present management conditions and future I&R plans.

In May, the Hawaii Audubon Society adopted the Kii Unit of James Campbell NWR under their "Adopt-a-Refuge" Program. Discussions with board members of the Society occurred throughout the year to coordinate their activities.

### 5. Research and Investigations

James Campbell NWR 85 - "Management and Selection of Endangered Waterbirds in 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. Stephen Berendzen  
Mr. Kenneth Neithammer

Collaborators: Stewart I. Fefer, Refuge Biologist  
Jim Krakowski, 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 will run through June 30, 1987. Field observations and impoundment manipulations began in January 1985 and will continue through December 31, 1986. The final project report will be submitted June 30, 1987.

The wetland national wildlife refuges in Hawaii were established to preserve and enhance habitat for Hawaii's four endangered waterbirds (stilt, coot, moorhen, duck). 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 do more with less.

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

1985 Progress:

Data are being collected on waterbird usage of wetlands and the value of specific vegetation types and invertebrates to waterbird habitat. Manipulation of wetland habitat on the Kii Unit was also conducted to observe responses of vegetation, invertebrates, and waterbirds.

VEGETATION ANALYSIS 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). Twenty replicate quadrates for each dominant plant species were selected from ponds by stratified random sampling and permanently marked. Stem densities, stem height, and phenology were monitored monthly. Preliminary analyses indicated that counts of stem densities were too variable to be useful as measures of plant growth, thus stem density sampling was discontinued. Cover-mapping individual ponds became the preferred method of monitoring changes in vegetation structure. Aerial photographs taken semi-annually will provide current information in species composition and expansion or reduction of perennial vegetation.

Vegetation and water manipulations were made in Ponds B, C, F, and G at the Kii Unit to develop methods to control undesirable vegetation. Initial drawdowns of ponds began in late June and treatments continued through October (water management of the Kii Unit is covered under Section F.2.). Manipulation treatments included herbicide spraying and burning, deep discing, shallow discing, and mowing. Currently, California grass and pickleweed are the two primary problem species on the Kii Unit. Preliminary results indicate that a combination of mowing and rapid reflooding successfully controls pickleweed, while herbicide spraying followed by burning is an effective control technique for California grass. Although no further vegetation control treatments are planned during the remainder of the study, vegetation sampling will continue.



University of Missouri researcher Steve Berendzen sampling a vegetation plot at the Kii Unit. SP (YCC enrollee)

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Manipulation of impoundments on Kii Unit were conducted in late summer and early fall. Four impoundments were drained, and two of these had extensive growth of vegetation (California grass and pickleweed) with little open water. Vegetation was removed or killed by spraying with herbicide, burning, mowing, discing, or a combination thereof. Control plots were left in each pond to determine rate of expansion and to compare with manipulated areas for waterbird and invertebrate usage. These ponds were reflooded soon after manipulations to flood sprouting vegetation.

Small patches of undesirable vegetation were removed from the other two manipulated ponds, but manipulations focused on inducing vegetation growth in open areas.

Bare ground was disced in hopes of allowing germination and sprouting of seeds. However, after drawdown and thorough saturation by rain, very little sprouting was observed.

After more than two months of drawdown with periodic rains, vegetation appeared to expand out by rhizome from existing areas, but little sprouting from seeds was observed. Some of these plant species apparently are not heavy seed producers and germination of these species might not be seasonally regulated.

Control of undesirable vegetation was done by several methods, but each plant species has characteristics that make certain methods more feasible for intended control. Manipulation of these impoundments to create more open water/vegetation interface is desirable to provide good waterbird habitat.

#### INVERTEBRATES

Monthly sweep and core samples were taken to monitor changes in nektonic and benthic aquatic invertebrate populations in seven plant zones (makai, California grass, knottweed, pickleweed, bulrush, barnyard grass, and water hyssop) in ponds at the Kii Unit. Invertebrate populations are being monitored in the vegetation treatment plots in Ponds F and G, 12 and 14 plots respectively. A total of 260 core and sweep net samples are made quarterly. Preliminary analyses indicate that there are large differences in numbers of invertebrate families and total invertebrates between plant zones. For benthic invertebrates, pickleweed had the highest number of invertebrate families ( $x=1.8$ ) per sample, while water hyssop had the highest number of total invertebrates ( $x=11.2$ ) per sample. For nektonic invertebrates, knottweed had both the highest number of invertebrate families ( $x=6.3$ ) and total invertebrates ( $x=220.2$ ) per sample. The lowest numbers of invertebrates were found in California grass.

## WATERBIRD SURVEYS

Waterbird usage of ponds in relation to drawdowns and vegetation treatment plots were monitored by monthly waterbird surveys. Weekly activity budget information will be gathered in 1986.

To compare waterbird usage of island wetlands, nine semi-monthly waterbird surveys of 10 to 11 Oahu wetland sites important to waterbirds were made between February 6 and June 12. Preliminary analyses of these waterbird census data indicated that brief, intermittent visits to these sites did not adequately assess waterbird usage. The cryptic behaviors of the waterbirds make them difficult to count accurately during only brief visits. Thus, a different survey method was developed.

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. Consecutive counts give consistent numbers of coots and moorhen, two species which are most difficult to count.

## WATER CHEMISTRY

At the 10 surveyed wetland sites, 3 water samples per month per pond or area will be taken in 1986. Salinity, alkalinity, conductivity, and pH will be determined for each sample.

## NEST SURVEYS

Systematic sampling of waterbird nest sites on the Kii Unit were conducted every 3 weeks. Over 160 nests of 5 waterbird species have been found in 1985. Approximately 15% of these nests were lost due to flooding, while 14% were known to have been destroyed by predators. Continued nest surveys will provide important information on the seasonal patterns of waterbird nesting, productivity, and nesting habitat requirements.

## E. ADMINISTRATION

### 1. Personnel

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 Kakaia NWR's.

## 2. Youth Programs

Six YCC enrollees participated in an eight week (June 10 - August 3) non-residential camp. Their activities on the James Campbell NWR included: clearing vegetation from fencelines, repairing fences, clearing vegetation from waterbird nesting islands, 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 David Smith was commended for his fine job of supervision.



YCC enrollees assisted the University of Missouri wetland researchers by collecting vegetation data at sampling plots at the Kii Unit. SB

## 4. Volunteers Program

On January 27, 26 members from the Honolulu High School Hikers Club volunteered their hard labor to clear vegetation

from stilt nesting islands at the Kii Unit.

In November, nine volunteers from the Sierra Club reshaped islands in Pond B of the Kii Unit using only hand tools. Their efforts greatly enhanced the islands for stilt nesting.

Ms. Christine Fraley of the University of Toledo, Ohio volunteered for 10 weeks. She assisted Steve Berendzen in the collection of field data for the University of Missouri wetland study at James Campbell NWR. She also assisted in the compilation and completion of station wildlife output reports. She earned 16 credits from the University of Toledo for work she conducted on the refuge.



A group of High School Hikers clearing vegetation from an island in the Kii Unit. JK

#### Adopt-a-Refuge Program

On May 15, 1985, following the guidelines of the National Audubon Society's "Adopt-a-Refuge" Program, James Campbell NWR was formally adopted by the Hawaii Audubon Society. The Society has offered the following services for the James Campbell NWR: (1) provide leaders for public tours; (2) work with the refuge to develop and construct educational signs; and (3) work with the refuge to design and produce brochures, posters, or other visual materials to aid in describing the activities of the refuge.

The refuge initiated a docent training program in November for Society members interested in leading tours on the Kii Unit. Prospective docents were given handouts containing information on the history, management, research, ecology, and logistics of the refuge. Specific information was identified as required material to be presented during a tour. This was followed by a field trip to the the Kii Unit in November, where refuge staff reviewed refuge logistics and information to be presented in a tour. The final part of the training is a written test on material from the handouts. By year's end, 15 Audubon members were establishing dates to take the written test.

This should be a great asset to the refuge, 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 85 budget for the Oahu and Molokai refuges was as follows:

|                     |                |
|---------------------|----------------|
| Travel              | \$ 6.0K        |
| Administration      | 2.3K           |
| O&M                 | 12.3K          |
| Large ARMM Projects | 31.0K          |
| Small ARMM Projects | 5.5K           |
| RPRP Projects       | 17.5K          |
| TOTAL               | <u>\$74.6K</u> |

The ARMM and RPRP projects included maintenance of fence, windmills, and pumps that could not have been accomplished with the limited O&M dollars.

## 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., Ruppia matitima 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 angustata, 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.

#### Kahuku Flood Control

In May, refuge staff Leinecke, Krakowski, and Woodside met with the Kahuku mayor, land managers of the Campbell Estate, and members of the Kahuku Housing Association to discuss flooding problems in the Kahuku watershed. The mayor, Campbell Estate and the Association believed that potential flooding problems existed and several water constricting points located on the refuge were a threat to life and property off the refuge. The refuge agreed to review the points of concern and arrange for another meeting to discuss the refuge's plan of action.

In July, Bob McVein (RO-Hydrologist), along with refuge staff Krakowski and Woodside, met with the Kahuku mayor and representatives of the Kahuku Housing Association and the Estate of James Campbell to discuss the potential off-refuge flooding problem. The refuge agreed that drainage constricting points did exist on the refuge, however other factors are present that will always threaten life and property in the Kahuku area. They include: (1) The Kahuku flood basin covers an extensive area within which the highway, housing and agricultural developments have encroached and thus will always be subject to flooding; (2) The basin has no natural outlet for drainage to the sea. A small outlet was cut by the sugar company years ago but it is not large enough to handle flood conditions; and (3) Drainage blockages/constrictions exist above the refuge that also contribute to delay in movement of water. Regardless, the refuge's constricting points do slow drainage for the basin. Therefore, the refuge agreed to remedy constricting points on the refuge by constructing 3 flood swales on the Kii Unit. These swales would be excavated to an elevation that would pass water only at times of life and property threatening flood conditions. The mayor, Kahuku Housing Association, and Campbell Estate all agreed to help the refuge construct the flood swales on the refuge. After the meeting, McVein took elevation readings on the Kii Unit. McVein made construction recommendations in the regional office after review of his readings and past records of flood water conditions.

Three flood water swales in the dikes of the Kii Unit were completed by early December (see Section I.1 for construction details).

## 2. Wetlands

### KII UNIT:

Management within the Kii Unit consisted of maintaining water levels within Ponds A, B, C, D, F, and G by pumping water out of the main drainage canals. A five hp. electric pump along with two low-lift wind generated pumps moved water to the ponds. One is a 13.5" pump (Pump C) that is driven by a 12' windmill. The other is an 18" pump (Pump D) that is driven by a 14' windmill. Some of the nesting islands within the Kii Unit were cleared early in the year to provide stilt nesting habitat. Mechanical and herbicide control (Sec. F.10) was used to set back the Pluchea and Batis (pickleweed).

Water was pumped by windmill and electric pump to Ponds A, B, C, D, and F through late June. Unfortunately, during the spring period, proper flooding of Ponds A, B, and C was thwarted by mechanical problems with both windmill pumps. Drastic fluctuations in these ponds resulted in the loss of some waterbird nests.

Early in the summer, new staff gauges were installed in Ponds B, C, D, F, and G.

The wetland researchers controlled water elevations in the ponds to suit study needs. In late June, they initiated drawdown of Ponds F and G in order to conduct vegetation control manipulations. Pond F was overgrown with 5 foot high California grass. Pond G had a dense monotypic stand of pickleweed. Low spots in the two ponds had to be pumped and a week of evaporation was required to adequately dry the ponds. However, Pond C was held too high during this period and subsurface flow of water occurred on August 9 which saturated Ponds F and G, delaying manipulations. After reducing the elevation of Pond C and again pumping the remaining water, the two ponds were ready for treatments by late August/early September.

In September, the following vegetation treatments were used on the California grass and pickleweed stands: herbicide spraying, discing, flooding, mowing, and combinations of these.

Specific vegetation and soil manipulations occurred during the year.

POND F

After pond drainage, the California grass was found to be too dense and matted to be disced. It was necessary to herbicide, burn and follow with discing. Treatment plots were sprayed with 2% Roundup on July 10 and required 3 weeks drying to facilitate burning. Controlled burning was delayed until September 12, due to weather conditions and lack of available manpower. The treatment area burned very well. Sprouting of some root clumps occurred within 5 days of burning.

Bare ground areas of the pond bottom were shallow disced to evaluate floral and faunal response.

The John Deere 302 tractor and large rotary mower worked well on the dense California grass area. The Ford 1700 tractor was also used, but found to be too small for this operation.

POND G

Areas of pickleweed habitat designated for herbicide treatment were sprayed with 2% Banvel. This vegetation proved to be very hardy; small stems and a portion of the plant often survived, unless sprayed heavily. Thorough drying of pickleweed was only achieved in small patches. Some plants sprouted after spraying and grew rapidly.

Burning of pickleweed was attempted; however, only the driest patches burned. Three small patches burned and ranged from 400 ft<sup>2</sup> to 2,000 ft<sup>2</sup>.

Discing was attempted, but the slick clay soil and thick vegetation prevented adequate tillage.

Mowing of pickleweed worked very well. The Ford tractor and small rotary mower cut this plant easily.

POND C

In September, while the pond was dry, large areas of California grass were sprayed with 2% Roundup.



University of Missouri researcher, Steve Berendzen, mowing Batis in Pond G of the Kii Unit. Mowing was one of several vegetation manipulations studied. JK

#### REFILLING PONDS C, F, G, AND D

Throughout the year, much was learned about the hydraulics of these ponds. A subsurface flow of water exists between these ponds and the main ditch system. This flow, or leakage, is quite evident in certain areas of the dikes. The leaking dikes are typically smaller in volume and lower in elevation. Most likely, the dikes were not adequately compacted during their construction, which would augment the problem. There may also exist a flow of water under some of the dikes. These facts make it difficult to hold water high or low in any individual pond. As a result, water in the entire system must be managed when considering water manipulations of any one of these ponds.

The windmill started pumping water into Pond C on September 15, and a few days later the crisafulli pump was used to fill Pond D. We had hoped to run water from Pond D to Pond F, but learned that Pond D's elevation was too low to do that effectively. On September 24, the crisafulli was switched over to Pond C. However, Pond C is twice as large as Pond F and the water level in Pond C rose too slowly. On September 24, the water level in Pond F was only 3.67' msl.

and at least 4.5' msl. was needed at that time to drown the fast growing California grass in the pond. Another pumping method was tried. The crisafulli pump was set in the Kii drain and connected to 100' of 12" PVC, which made it possible to pump directly into Pond F from the Kii drain. The PVC pipe was scavenged from the Amorient Aquafarm's pipe boneyard. A water level of 5.04' msl. was finally reached in Pond F on October 1. The crisafulli continued to be used until the entire system (Ponds C, D, F, G) was filled (10/22). It took a total of 166 hours of crisafulli use to fill the ponds. Water levels in the two higher Ponds (C and F) began receding soon after pumping was terminated. The 14' windmill cannot hold the system at high water levels. Even if the crisafulli were pumping, the main ditches have to be held high to hold water in this system. This is in conflict with the desires of the Campbell Estate, who demand that we lower the main ditch levels. The problem of the subsurface water flow must be addressed by reconstructing or adding material to the dikes or bottoms of the ponds in leakage areas.

California grass in Pond F stopped growth after being flooded and it apparently died after 4 weeks of continual flooding. The mowed pickleweed in Pond G also died back after the prolonged flooding period.

Pickleweed seeds were observed floating on the surface of Pond G soon after flooding. Mowing and spraying of this vegetation apparently induced early senescence; seed pods decomposed, thus releasing the seeds. The leeward side of Pond G had a 3 inch accumulation of this seed, and ducks and coots were frequently observed feeding in this area.

#### POND B

Windmill pump "C" was turned off and this pond was drained in September. Portions of the pond were shallow disced, with hopes of encouraging germination and sprouting of seeds. The pond was thoroughly saturated by rain following discing; however, after 3 weeks no sprouting occurred.

In December, Pond B was allowed to refill slowly.

Most of the heavily vegetated islands in Ponds B, C, F, and G were scraped with the tractor and blade to clear them of Pluchea, California grass, or pickleweed unless they were considered valuable nesting sites. Some of the taller steep-sided islands were shaved to a lower elevation and were smoothed to a gentler slope.

#### Punamano Unit:

Water levels remained relatively high in this unit. This was due to normal spring flow and rainfall drainage

collection at the unit, coupled with high water levels in the Punamano Ditch. The bulrush areas are expanding on the unit and some control to create diversity and desirable open water interface is needed.

### 3. Forests

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

### 9. Fire Management

During the months of August and September, prescribed burns took place on the Kii Unit. Refuge staff and researchers from the University of Missouri conducted the burns. The burns were conducted in Ponds B, C, F, and G to control California grass. The most successful burn took place in Pond F, which was reflooded after the burn.



A burned area of California grass at the Kii Unit. The vegetation must first be treated with herbicide. JK

## 10. Pest Control

Vegetation control of Brachiaria sp. (California grass) on the Kii Unit is a major part of the management duties. In February, Roundup herbicide was applied to the banks of the major drainage canal. Good results were achieved using a 2% solution. Banvel herbicide was used to control Batis sp. vegetation on nesting islands within the Kii Unit.

The dikes separating the Kii ponds serve as refuge roads. Brachiaria sp. on these roads must be mowed every 2-3 weeks to control it and to allow for vehicle passage.

Ron's Construction Company of Oahu was issued an \$8.0K heavy equipment rental contract to clear California grass and silt from the Punamano Ditch between the Punamano Unit and the Sand Road Bridge. This part of the ditch is approximately 1 mile long. The work was accomplished during the months of September and October.



Ron's Construction, using a JD 450 with an extending bucket to clear the Punamano Ditch.  
JK

## 11. Water Rights

Bruce Smith, a Kahuku prawn farmer, is proposing to build a 20-acre salt water shrimp facility adjacent to the Kii Unit of James Campbell NWR. Refuge staff met with Mr. Smith several times during the months of May and June to discuss

the impacts of the facility on the refuge and surrounding environment. Initially, he proposed to build a portion of his facility in an adjacent wetland that was used extensively by endangered waterbirds. In October, Krakowski coordinated with John Emmerson of the U.S. Army Corps of Engineers and Andy Yuen (FWS-ES) on the mapping of wetland boundaries. After the boundaries of this wetland were marked, Smith decided to move his operation off to the edge of it. He now only requires a Special Management Area Permit from the State of Hawaii. His plans include a settling basin just north of the Kii Unit, housing for a caretaker, and lights for security. He believes that the settling basin will drain salt water from his operation to the sea and not into the refuge. The refuge has asked for a percolation test, which was not received by year's end. The housing will disrupt the aesthetics of this undeveloped coastline area. The caretaker will undoubtedly have dogs for security, which may cause problems for the waterbirds and albatrosses. The lights may deter green sea turtles from nesting on the Kii Unit's adjacent beach. This is the only green sea turtle nesting area on Oahu, and George Balazs (National Marine Fisheries Service) believes that the lack of lights in this area may be the reason why the turtles nest on this beach. The refuge is opposed to this building proposal; however, the land is owned by Campbell Estate, who promotes development, and Mr. Smith is quite determined. The permit process slowed him down and he did not start construction before the winter rain season. He now plans to start construction during the spring/summer of 1986.

## 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 (stilt, coot, moorhen, and duck) nest and maintain populations on both units of James Campbell NWR. Normally, the Kii Unit contains higher numbers of these birds. Census data more often comes from the Kii Unit, due to the research work being conducted there.

Kii Unit:

Kii stilt numbers normally ranged from 70-100 with a peak of 140 recorded in July. Coots normally ranged from 100-200 with a peak of 227 in March. The Hawaiian duck ranged from 20-40 birds during the year with a peak of 58 counted in March. These three species move quite readily between the Amorient prawn farm and the refuge, which may explain the fluctuations in the monthly bird numbers. There was a definite increase in the number of Hawaiian ducks using the Kii Unit in 1985. In 1984, the refuge average population was 8-14 birds. The moorhen is a difficult bird to observe and normally 3-17 are censused on the Kii Unit. (See table on following page.)

Nesting reports for all 4 waterbirds were up from past years. Over 160 nests (figure includes fulvous whistling duck nests) were found. This is due to the intense search effort by the University of Missouri researchers. Data on nest success and recruitment has yet to be compiled and analyzed. However, it is known that approximately 15% of the nests were lost due to flooding and 14% were lost due to predation. A preliminary analysis indicates that many of the nests are hatching, but the young are not surviving.

Also, there appears to be a movement of Hawaiian duck broods from the Kii Unit to the Amorient Prawn Farm. We are not sure why this movement occurred, but the Farm does offer a different type of food base and the cover habitat is different. The Prawn Farm contains 140 acres of 1+ acre ponds. The area is mowed regularly to the water's edge and has a park-like appearance. Mongoose numbers are limited on the farm, due to the grass being too short to provide mongoose cover. Waterbirds resting on the dikes of the ponds can also see quite a distance, and it is difficult for any mammalian predator (mongoose, dog, cat, rat) to stalk them.

In 1983 and 1984, during the months of June and July, several green sea turtles (Chelonia mydas) nested on the beach adjacent to the Kii Unit of the refuge. Refuge personnel surveyed this area regularly during the summer of 1985, however no turtle nests were found. George Balazs of the National Marine Fisheries Service stated that we shouldn't give up all hope. Occasionally, the turtles will skip a year and not return to nest in a specific location. This is the only recorded green turtle nesting area on Oahu.

Punamano Unit:

Punamano stilt numbers normally ranged from 2-5. Coots normally ranged from 5-20 with a peak of 27 in May. The Hawaiian duck averaged from 5-13 birds during the year with a peak of 19 counted in July. The moorhen average

population was 3-5 birds. Again, the moorhen is a difficult bird to observe and the tall and dense cover of bulrush within this unit makes censusing even more difficult.



The endangered Hawaiian "ae'o", or black-necked stilt, is very similar to its mainland counterpart. RJS

Refuge staff participated in the State of Hawaii's semiannual waterbird count by censusing the refuge on January 17 and July 30.

Salvaged Waterbirds: 1 coot and 1 stilt were salvaged from the James Campbell NWR during the year. Cause of death could not be determined.

### 3. Waterfowl

#### Kii Unit:

Wintering and migratory waterfowl use the refuge September through May. Northern shovelers and pintails are the most numerous, numbering 60-100 birds on the Kii Unit. Other ducks observed include wigeon (6-12), Eurasian wigeon (1-2), green-winged teal (2-14), blue-winged teal (5), mallard (2), scaup (3-17), ringneck (3), canvasback (1), and fulvous whistling duck (3-10) which is believed to have been introduced from captivity and now appears to be established.

Punamano Unit:

Twenty-nine pintail ducks were observed on this unit in March.

Occasional sightings of scaup, shoveler, Eurasian wigeon, ringneck, and fulvous whistling duck were noted during the year.

The Amorient Aquafarm, which farms 140 acres of water for prawns, is adjacent to the refuge and provides additional wetland habitat for waterfowl and endangered waterbirds.

4. Marsh and WaterbirdsKii Unit:

The black-crowned night heron population normally ranged from 25-50 birds with a peak population of 59 recorded in May. Frequently, herons are observed in areas adjacent to nesting stilts. The disappearance of so many young waterbirds has led the refuge to suspect heron predation as the cause. Several times during the year, night herons were observed taking the young of the endangered waterbirds. A black-crowned night heron food habit study in 1985 on the adjacent Amorient Aquafarm has given us some information on the heron food habits. However, individual birds or refuge herons may have acquired a skill or taste for the waterbirds. Further study is needed before harassment or control is implemented.

The cattle egret population normally ranged from 18-24 birds with a peak population of 51 recorded in April. However, adjacent land does harbor an egret roosting area where 300 birds have been counted. It is uncertain what impact the cattle egrets may have on the endangered waterbirds as predators or vectors of avian disease.

Punamano Unit:

The black-crowned night heron population ranged from 4-11 birds.

The cattle egret population ranged from 5-16 birds throughout the year.

5. Shorebirds, Gulls, Terns, and Allied Species

The refuge is one of the better shorebird habitats in the state and these birds may be seen there 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:

The most common shorebird species included: American golden plover (12-50 birds, peak of 198 in August, absent during the months of June, July), ruddy turnstone (5-40 birds, peak of 125 in February, absent only during the month of June), sanderling (5-16 birds, peak of 39 in October), and wandering tattler (4-7 birds, peak of 11 in August). Other incidental shorebirds observed in 1985 included: long-billed dowitcher, pectoral sandpiper, common snipe, and semi-palmated plover (all less than 10 birds).

On rare occasions, a gull is observed on the refuge. During the month of January, a lone Bonaparte's gull was regularly seen on the Kii Unit. A Caspian tern was observed on the unit during the months of January and February. On rare occasions, great frigatebirds may be seen swooping down on the refuge to get a drink of fresh water.

During the winter of 1984-1985, a group of five Laysan albatross started to land on the beach area near Kahuku Point, which is less than a mile from the refuge. They used the site for roosting and courtship display. No nesting occurred. The birds were present only during the winter months, since they return to the sea for the summer months. Occasionally, the magnificent birds were observed flying low over the Kii Unit.

#### Punamano Unit:

The most common shorebird species included: American golden plover (2-10 birds), ruddy turnstone (1-2 birds), sanderling (5-10 in the months of April & May), and wandering tattler (1-2 birds).

#### 6. Raptors

Short-eared owls (Pue'o) were occasionally observed over the grassy areas of the Kii Unit. The Pue'o probably nests on the refuge, although no nests were actually located.

#### 10. Other Resident Wildlife

Approximately 5-10 ring-necked pheasants reside on the refuge. In the past, local hunters have crossed refuge boundaries in search of these birds. No pheasant hunting or related trespass violations occurred in 1985.

#### 14. Scientific Collections

On June 26, Biologist Tim Ohashi shot 4 black-crowned night herons on the Kii Unit. Ohashi is studying the heron depredation problem at the nearby Amorient prawn farm. A portion of the study investigates the food habits of the Amorient herons. The refuge birds were shot to determine comparative food habits of refuge herons.

#### 15. Animal Control

Live traps were occasionally set during the spring, summer, and fall months during 1985 to catch mongooses, dogs, and cats. The mongoose is a prolific animal that is quite an efficient predator on the waterbirds and their young. The trapping program is designed to set their numbers back during peak waterbird nesting periods. A total of 178 trap nights captured 74 mongoose, 2 dogs, 1 cat, and 3 rats.

### H. PUBLIC USE

#### 1. General

The Kii Unit of James Campbell NWR has been designated 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 or local bird groups to visit the refuge. Service efforts to increase public use during this period were directed toward the training of Hawaii Audubon Society docents to lead group tours on the Kii Unit.

The refuge was visited by 14 groups consisting of 426 people during the year.

Several reasons for the lack of use include: lack of restroom facilities, lack of interpretive displays, and the refuge's distant location on the north shore of Oahu.

#### 2. Outdoor Classrooms - Students

The refuge was visited by six groups containing 199 students during the year. Refuge staff conducted all of the tours.

The docent program will help secure the refuge's

environmental education objectives for the Kii Unit. Docents will try to encourage the use of the refuge as a classroom. Ecological studies involving the animals, plants, invertebrates, water chemistry, etc. will be promoted.

### 3. Outdoor Classrooms - Teachers

Krakowski conducted a docent training session for Hawaii Audubon Society volunteers on November 9. Twelve docents attended the training which took place at the Kii Unit. The animals, plants, and tour lecture material were topics of the 4 hour session.

### 6. Interpretive Exhibits/Demonstrations

On February 8, Dick Kuehner, Chris Holden (Regional Office I&R Specialists), Leinecke, Krakowski, and representatives of the Hawaii Audubon Society met with trustees of the Campbell Estate to discuss I&R plans for James Campbell NWR. Plans included: entrance signs, interpretive exhibits, boardwalks, kiosks, and tour routes. The Audubon members reviewed the role of the proposed Adopt-a-Refuge program and how they could assist the refuge in attaining future environmental education objectives. The Estate was quite receptive of the new plans. Considerable review of refuge I&R plans occurred during the year.

### 11. Wildlife Observation

Groups from Foster Gardens, Audubon Society, University of Hawaii, Hawaii-BYU, and the Sierra Club toured the Kii Unit of the refuge.

### 17. Law Enforcement

An occasional weekend problem is the trespass of fishermen on the Kii Unit. Many 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

In September, North Oahu Construction was given a \$2.5K contract to clear brush along the east and north boundaries

of the Punamano Unit. The refuge plans to construct a boundary fence around Punamano in 1986. The company brought in three pieces of heavy equipment and cleared 3,400 foot strip of haole koa and kiawe.

On October 22, Krakowski and Woodside met with Campbell Estate representatives Dybdal and Gibson to discuss the refuge's plans for fencing the Punamano Unit. Presently, portions of this unit's north, south, and west boundaries are under water. The refuge proposed to erect a fenceline on dry land and establish a fencing agreement with the Estate. The Estate cannot lease out the wet areas of concern. Dybdal gave the refuge permission to fence the southern area, if the fenceline did not interfere with the wheeled irrigation line. However, he balked at the idea of the fence agreement on the west and north sides until after he conducts a hydraulic test. Dybdal would like to run the refuge pumps for an extended period of time in order to identify the lowest water level that can be maintained in the Kahuku Basin. He contends that the refuge is holding water higher in the Kahuku Basin than when the refuge was first established, thus setting the Punamano Unit at an artificially high level. This is true. Prior to the refuge occupation in the basin, the Sugar Company maintained several pumps that constantly drained water from the main drainage ways and kept the basin's water level low. The refuge is not required to keep the drainage ditches or basin at any specified levels. Occasionally, Estate management will complain to Woodside that water in the main ditches is too high. Normally, this occurs during the winter period. At these times Woodside will lower the pump floats which lowers the ditch level. When a need for more water in refuge impoundments arises, he raises the floats. The refuge must keep main ditch water levels high for most of the year in order to manage for endangered waterbirds. It appears that a showdown is on the horizon.

The construction of three flood water swales in the dikes of the Kii Unit was initiated on November 12 and completed by early December. This action was in response to a plea by the Kahuku Community to prevent flooding of their housing and agricultural areas. It was determined that constrictions in the flow of flood waters through the refuge would contribute to the slow drainage of the Kahuku Floodplain. The three swales were excavated to a depth of approximately 3.0' msl. The refuge swale project was a joint effort including: the landowner (James Campbell Estate), Kahuku Housing Association, and the refuge. Campbell Estate contributed \$3,000 for rental of heavy equipment to excavate the swales, they also permitted the use of as much coral rock as needed to cover the swales from one of their rock quarries. Kahuku donated the use of their front-end loader and operator to load rock on trucks at the Estate quarry. The refuge replaced the water pipe and electrical lines that went through two of the swales, rented

coral hauling trucks for a day, and supervised the construction. The total refuge expenditure - \$2,500 (not including staff time).



The completed emergency flood swale located on the railroad right-of-way between the pump-house and the 12' windmill. JK



Finished emergency flood swale located at the junction of the Hospital Drain and the Punamano Ditch. JK

Woodside installed a new 24" culvert with flashboard riser in Pond E. This water control structure will serve as the outlet for this pond. Prior to this installation, the refuge had no control of water levels and salt water was free to back up into this pond during high tides.



Installation of a new 24" flashboard riser and culvert in Pond E. JK

## 2. Rehabilitation

Retired Univ. Hawaii Professor Don Avery and Bryan Young have been developing innovative pumps and stroke controls that can be used on windmills. The refuge has encouraged their research and cooperated with funding for the systems used on the refuge. No low-lift pumps adaptable to windmill pumping are commercially available larger than six-inch. Their pumps are innovative in that they are: (1) double acting; they pump on the up and down stroke; and (2) larger than the conventional six-inch pump. The Kii Unit has two of their windmill pumps. During 1985, they continued to refine materials and efficiency of these pumps.

## 3. Major Maintenance

In September, Ron's Construction initiated an \$8K heavy equipment rental contract to clear the Punamano Ditch from the Punamano Unit to the Kii Unit. The refuge is required to maintain this ditch under the terms of the Campbell Estate lease agreement. The ditch was clogged by California grass and silt. A 450 John Deere dozer with an extending backhoe was used for the job. The 1 mile long ditch was cleared by early December.

The 14' windmill pump went out on December 30. Byran Young disassembled it and took the pump into the shop for repairs.

#### 4. Equipment Utilization and Replacement

On August 21, major holes were discovered below the waterline in the casing walls of the 5 and 40 hp. pumps at the Kii Unit. Apparently, an electrolytic reaction had developed between the impeller and the casing of these 4 year old pumps. These pumps are required for flood control and emergency procurement procedures were initiated for repair. The prompt replacement of these pumps prior to the advent of the winter rain season was imperative. The pump casings had to be manufactured on the mainland. Triangle Pump of Oregon was the low bidder and received the \$19.7K contract for replacement of both pump casings. The refuge commends the Regional Office's Engineering and Contracting staffs for their fast action in processing the contract. The new pump casings have a protective coating for use in brackish water. During the first week in December, Triangle Pump installed the casings. At year's end, the RO-EN office was securing an anode from the mainland to prevent the electrolysis reaction. It shall be installed early in 1986.



Arrival of the new 40 hp. pump casing at the Kii Unit. The roof of the pump house had to be removed for the installation. JK

In August, the refuge purchased an 8" crisafulli ditch pump for \$2.9 K with 50' of extra hose. The pump was used extensively by the University of Missouri researchers to control water levels in the Kii Unit.

## 6. Energy Conservation

The success of the Avery/Young pumps has kindled the desire to install more wind driven pumps to move water. Constant trade winds of 10-18 mph. make many of the wetland refuges practical sites for installation.

## J. OTHER ITEMS

### 2. Items of Interest

Regional Office personnel Striplin, McVein (RO-EN), and Ducret (RO-ACQ) visited the James Campbell NWR in 1985.

James Campbell NWR has been very fortunate to have Amorient Prawn Farm for a neighbor. Since its inception, the major product of the farm has been fresh water prawns. Amorient's fresh water habitat has been an important part of the endangered waterbird habitat in the Kahuku Basin. The farm has provided excellent maintenance (food, loafing, brooding) habitat for the birds and the refuge provides the lacking nesting habitat. The farm and the refuge have become a system and the birds pass freely between the two. The refuge's storage and maintenance yard is located on property leased by Amorient. Their night watchmen guard our facility as well as theirs. Occasional cross use of refuge and Amorient equipment and manpower has been common and benefited both entities.

1985 was the year that Amorient Prawn Farm began phasing out its freshwater prawn operation. The farm gives two reasons for doing so: 1) The fresh water prawn market is not doing well--salt water shrimp is taking over the market and 2) black-crowned night herons are eating up the profits. The FWS has been working with the farm on the depredation problem and, as a last resort, a kill permit was issued in 1985. However, the farm wants further assurances that they will be able to maintain the heron population at levels they deem necessary. This was an unreasonable demand. The farm has no solution for the poor fresh water prawn market.

One alternative that Amorient has suggested is the conversion of the farm to a salt water shrimp operation. This will have a negative impact on the James Campbell NWR. The effluent water from the farm flows into a ditch that

feeds both units of the refuge. The refuge has voiced its concern to the managers of Amorient about this problem.

By year's end, Amorient was not sure what it was going to do in the future. However, they are restricting their fresh water prawn production. Many of the ponds were allowed to go dry and no restocking occurred. No doubt, many birds will fall to predation and stress through competition as their habitat diminishes. Without this valuable wetland, many of the Kahuku Basin birds may have to use the refuge wetlands, which may result in overcrowding situations. The need for additional protected wetland areas in the Kahuku Basin has increased as a result. Natural wetlands exist between the two units of the refuge on Campbell Estate land. Efforts to protect these wetlands now become paramount.

### 3. Credits

Berendzen wrote Section D.5, and Krakowski wrote the remainder of the narrative.

### K. FEEDBACK

At times, refuge managers complain about the increase in paper work, red tape, and lack of support from the higher echelons of the Service's support branches. I am happy to have the opportunity to praise two support branch offices of the Portland Regional FWS Office: Engineering and Contracting and General Services. James Campbell NWR had an emergency at the end of the 1985 fiscal year. Two pump casings that serve to control flood waters had to be replaced. Immediate replacement was necessary and emergency procurement procedures had to be set into action. The Engineering and CGS offices were quick and decisive to meet our needs. CGS granted the Emergency Procurement authority and quickly moved the paperwork. The Engineering Office secured bids from mainland companies, worked out the logistics for the mainland company that won the bid, and kept the refuge informed on the progress being made. I would like to extend a big "mahalo" to Mike Bowen (CGS), Bill Striplin (EN), and their respective staffs for a job well done.

Jim Krakowski

PEARL HARBOR NWR

Honolulu, Hawaii

ANNUAL NARRATIVE REPORT

Calendar Year 1985

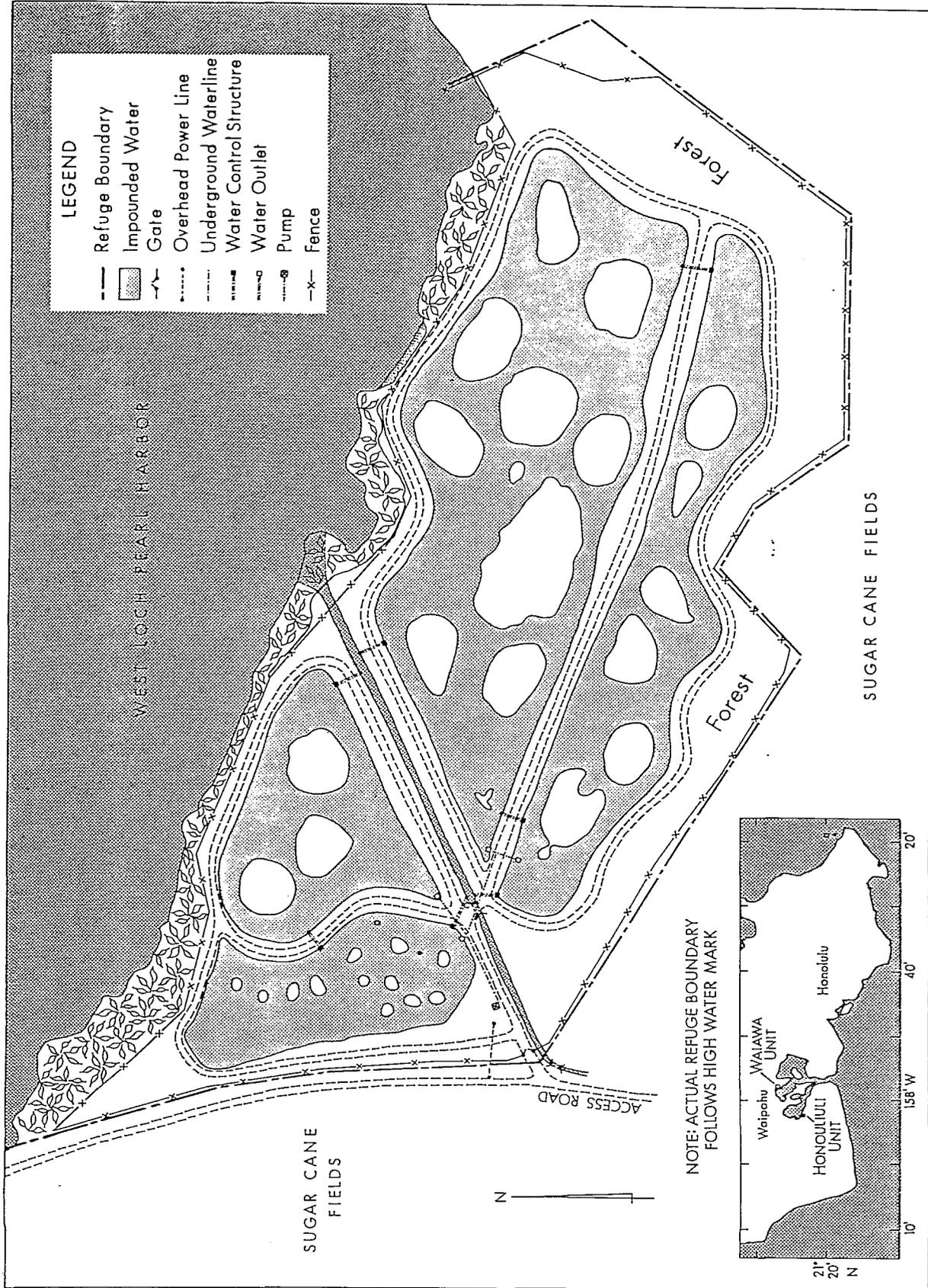
U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

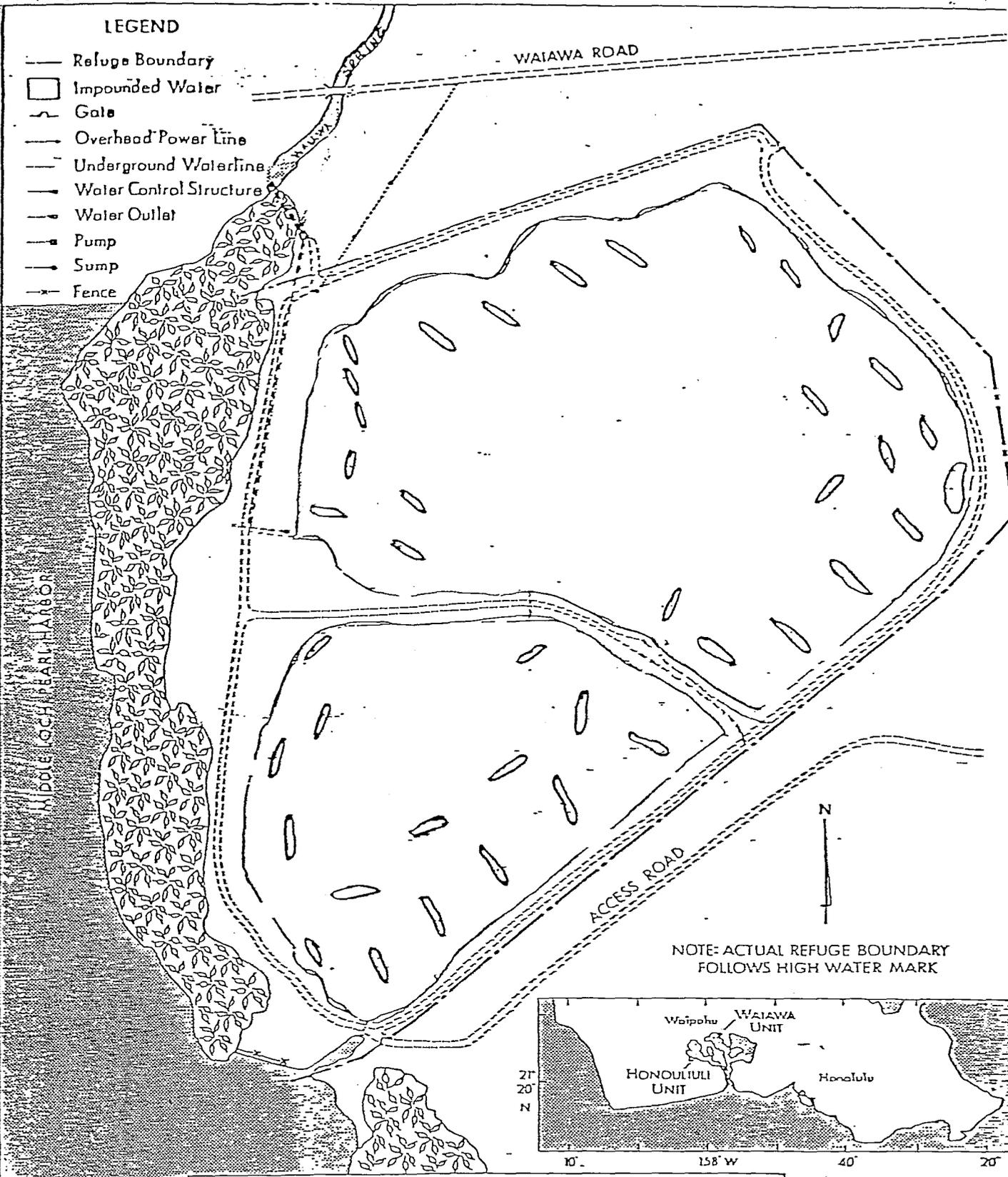
### INTRODUCTION

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, which inhabit the marsh environments. Low dikes retain shallow water impoundments on each unit. Electric pumps provide water for each of the ponds. The Pearl Harbor refuge habitats 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. Sugar cane fields cover the foreground, and the West Loch of Pearl Harbor borders the background of the refuge. RWR staff





LEGEND

- Refuge Boundary
- Impounded Water
- ⌋ Gate
- Overhead Power Line
- Underground Waterline
- Water Control Structure
- Water Outlet
- ⊠ Pump
- ⊠ Sump
- Fence

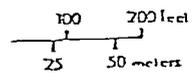
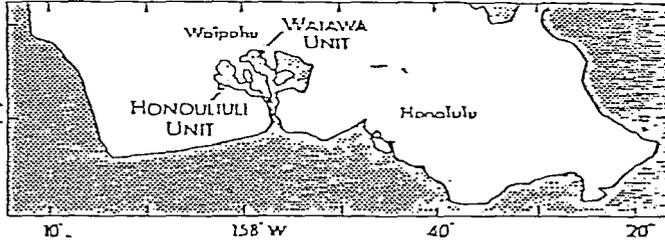
WAIAWA ROAD

MIDDLE LOCH PEARL HARBOR

ACCESS ROAD



NOTE: ACTUAL REFUGE BOUNDARY FOLLOWS HIGH WATER MARK



WAIAWA UNIT  
 PEARL HARBOR NATIONAL WILDLIFE REFUGE  
 Pearl Harbor, Island of Oahu, Hawaii

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service

PEARL HARBOR NATIONAL WILDLIFE REFUGE

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K. FEEDBACK

NTR

A. HIGHLIGHTS

An osprey was observed on a regular basis throughout the year at the Waiawa Unit (Sec. G.5). Hawaii Oceanic Institute collected milkfish and mullet for hormone research from the Waiawa Unit (Sec. G.11). Ron's Construction completed a \$29.0K equipment rental contract at the Waiawa Unit. The project improved the unit's endangered waterbird habitat (Sec. I.2).

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, 1985, reflects the climatic conditions at the refuge:

|      | Temp.<br>(ave.) | Precip. | Wind*<br>(resdir) | Wind**<br>(ressp) | Wind***<br>(avesp) |
|------|-----------------|---------|-------------------|-------------------|--------------------|
| Jan. | 69.7            | 1.70    | 300               | 0.4               | 7.3                |
| Feb. | 71.3            | 7.75    | 070               | 6.2               | 10.2               |
| Mar. | 73.3            | 0.58    | 060               | 14.2              | 15.0               |
| Apr. | 72.8            | 0.17    | 060               | 8.8               | 11.0               |
| May  | 74.5            | 1.60    | 060               | 11.4              | 12.9               |
| June | 76.6            | 0.77    | 060               | 10.2              | 11.5               |
| July | 79.6            | 0.42    | 060               | 11.8              | 12.4               |
| Aug. | 79.9            | 0.22    | 060               | 10.3              | 11.6               |
| Sep. | 78.8            | 2.36    | 060               | 6.6               | 9.4                |
| Oct. | 77.8            | 3.34    | 060               | 8.6               | 10.0               |
| Nov. | 73.9            | 1.54    | 010               | 1.8               | 7.5                |
| Dec. | 71.7            | 0.39    | 040               | 3.1               | 8.8                |

20.84 total inches

\* redir (resolute direction): a chain measure of wind direction - opposing directions cancel out one another; measures degrees azimuth from which the wind blows - normal trade winds are from the NE or 060.

\*\* ressp (resolute speed), again a chain measure - opposing winds cancel each other out; wind is expressed in miles per hour.

\*\*\* avesp (average speed).

Warmest recorded temperature: 93 degrees F. on August 20.  
Coldest recorded temperature: 52 degrees F. on February 2.  
Most precipitation in one day: 5.18 inches on February 15.

### C. LAND ACQUISITION

#### 3. Other

Both units of the refuge--the 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, hereinafter 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 Unit would require high initial development; in its present state, this area only provides marginal habitat for endangered waterbirds. Development of the Waiawa 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

#### 5. Research and Investigations

Hawaii's Oceanic Institute has been conducting studies on the propagation of milkfish and mullet for Third World countries. David Crear of AECOS Inc., Hawaii, has been doing the coordination between the Institute and the developing countries. The Institute is having difficulties obtaining adult fish for their research. The FWS gave the Institute permission to collect these two species of fish from the Waiawa Unit in 1985.

### E. ADMINISTRATION

#### 1. Personnel

David Smith was selected as crew leader of the Pearl Harbor NWR non-residential camp..

## 2. Youth Programs

Six YCC enrollees participated in an eight week (June 10 - August 2) non-residential camp. 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.

The YCC environmental education program included the following: Formal presentations from (1) Alan Holt of The Nature Conservancy (TNC) on the importance of Hawaii's ecosystems and TNC's responsibilities. (2) Carl Misaki (State Department of Land and Natural Resources Forester) on the State's Forestry program. (3) Bunny Vallesteros (Education Dir., Waimea Falls Park) on ethnobotany and land use practices of the early Hawaiians. Crew leader David Smith provided most of the remaining environmental education training with informal presentations on Hawaii's flora and fauna, land management mandates of various agencies and organizations, geology of the island, the fragility of Hawaii's ecosystems, and discussions on the condition of the environment in the future.



The 1985 Oahu YCC enrollees. Crew Leader David Smith is seated in the background. JK

## 5. Funding

The Wetland Refuges budget is allocated by the Hawaiian Islands Complex Manager. The FY 85 budget for the Oahu and Molokai refuges was as follows:

|                     |                |
|---------------------|----------------|
| Travel              | \$ 6.0K        |
| Administration      | 2.3K           |
| O&M                 | 12.3K          |
| Large ARMM Projects | 31.0K          |
| Small ARMM Projects | 5.5K           |
| RPRP Projects       | 17.5K          |
| TOTAL               | <u>\$74.6K</u> |

The ARMM and RPRP Projects included dollars for the maintenance of fence, pumps, and vegetation on the Pearl Harbor NWR that could not have been accomplished with O&M dollars.

## 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

The intensive habitat management efforts at Pearl Harbor NWR have been reasonably successful. Due to the small size of these man-made habitats, disturbance by humans and predators (feral dogs, cats, and mongoose) appears to be one of the major limiting factors in achieving maximum use by the endangered waterbirds.

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

feet or more above the water surface, provide a dry substrate for the establishment of undesirable upland vegetation. Smaller islands preclude dry land conditions and can be flooded to kill any unwanted vegetation which may become established.

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 the refuge's 3 hp. submersible pump and 600 feet of 4 inch PVC pipe. The unit is 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. Also, a much larger pumping system is needed to adequately manage this unit.

#### WAIAWA UNIT WATER MANAGEMENT:

From January 1 through February 5 the pump was active 12 hours a day, 8 a.m. through 8 p.m. Water levels varied from 1.77' msl. to 2.17' msl.

On February 5, the Waiawa Unit was drawn down in preparation for the summer Nesting Island Rehab construction project. The refuge wanted to learn how long drawdown would take and what additional pumping measures were needed to dry up the unit. We learned that most of the water could be drained by gravity; however, additional pumps were needed to remove water below the 0-foot msl. elevation, which is the invert of the outlet water control structure. The refuge's 4 inch pump, along with a rented 6 inch pump, were used to drain portions of the unit that are below the level of the outlet structure. By March 5, the oceanside pond was dry. The mountainside pond was also dry except for the deep pond in its center.

On March 22 the pump was activated and pumped for 24 hours a day in an effort to refill the ponds. By April 29, the oceanside pond had an elevation of 1.71' msl. and the pump timer was set back to 12 hours per day pumping. Pumping at the lowest tide provides the freshest water to the unit because the salt water wedge lies beneath the fresh water and moves up and down with the tide. Water levels remained at about 1.71' msl., with an oceanside pond salinity of 32 ppt. and a mountainside pond salinity of 24 ppt., until June 3, when the timer was reduced to pumping 7 hours per day (8 a.m. to 3 p.m.).

On July 3 the pump was shut off in preparation of the August construction project. The elevation at that time was 1.56'

msl. Final drainage occurred by August 1. After project completion in September and after additional shaping was accomplished, the pond was refilled on October 24. The pump operated for 24 hours per day until 11/24/85. On that day, the oceanside pond elevation was 2.07' msl. and the pump timer was changed to 11 hours per day (1 p.m. to midnight). The oceanside pond had a salinity of 30 ppt., while the mountainside pond had a salinity of 25 ppt. On December 30, the pump continued on its 11 hour per day schedule.

In December, the refuge continued its attempt to freshen the Waiawa Unit. The pump was running 11 hours per day during the lowest tides (1 p.m. to midnight). However, it was still getting readings of 25 ppt. in the mountainside pond and 35 ppt. for the oceanside pond. Early in 1986, we discovered the reason for the higher salinity readings--a crack in the bottom of the inlet structure was allowing salt water into the system.

#### HONOULIULI UNIT WATER MANAGEMENT

A 3 hp. submersible electric pump was active throughout the year maintaining water levels in the four ponds. The timer activated the pump daily from 8 a.m. thru 8 p.m. (12 hours per day). All ponds maintained a salinity less than 4 ppt. throughout the year.

### 3. Forests

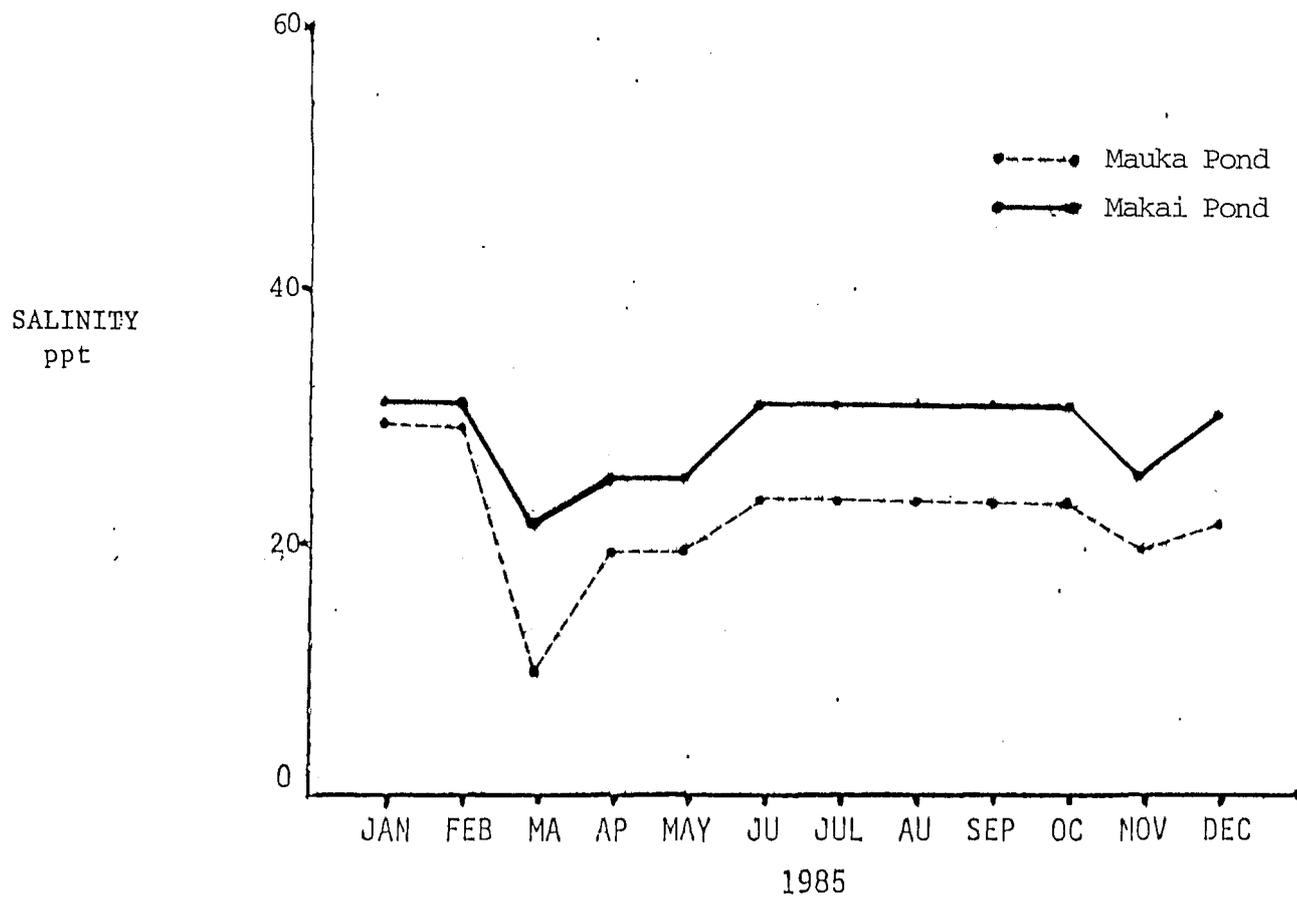
Both units of the refuge have introduced tree and shrub species that present management problems: On their upland areas is a shrub zone dominated by kiawe (Prosopis pallida) a type of mesquite, koa haole (Leucaena), and Fleabane (Pluchea). This vegetation is fast growing and must be cleared from fencelines 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 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 according to manufacturers instructions.



Waiawa unit salinity readings.

## 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. The other endangered waterbirds, shorebirds, and waterfowl have also benefited from these habitat modifications. The high salinity conditions at the Waiawa Unit has restricted the diversity of avifauna compared with the fresh-water conditions at the Honouliuli Unit. Efforts to decrease the salinity at this unit were begun in 1980 and continued through 1985.

### 2. Endangered and/or Threatened Species

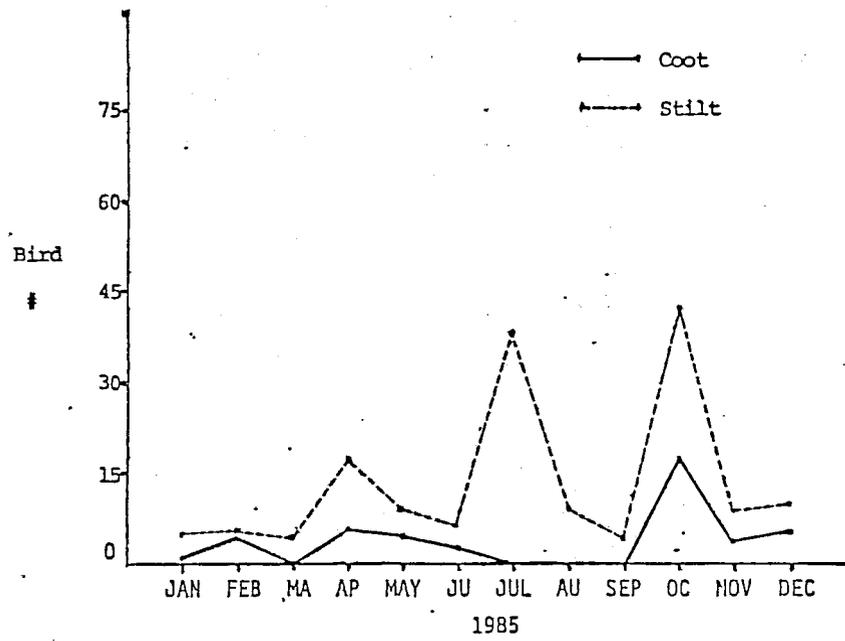
#### WAIAWA UNIT:

The brackish waters of the Waiawa Unit recorded fair numbers of three of the endangered waterbirds. Stilt numbers fluctuated between 5 and 10 for most months. This was due to reduced water areas during the two periods when this unit was drawn down. There were counts of over 40 stilts during the months of July and October, with a high count of 44 on October 15. Stilt nests and young were observed in April and May. Coot numbers were also down because of the drawdowns; their numbers ranged from 3 to 6 for most of the year. A peak population of 18 was recorded on October 25 after the unit was flooded. Hawaiian ducks were only occasionally sighted, with numbers ranging from 0 to 4. No coot or duck nesting was observed on this unit.

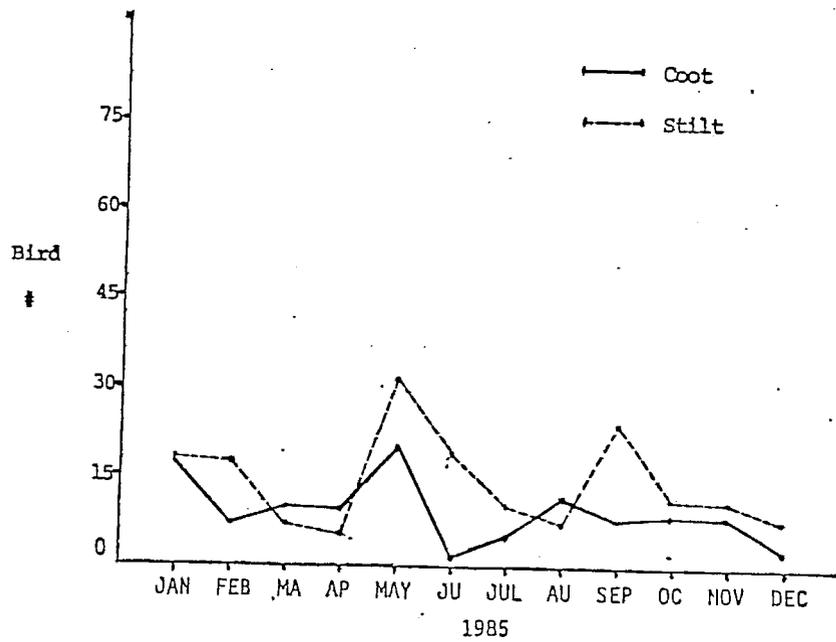
#### HONOULIULI UNIT:

The fresh water habitat at the Honouliuli Unit was used by all four of Hawaii's endangered waterbirds. Stilt numbers ranged between 10 and 25 for most of the year. The lowest counts were recorded in March (5 to 8 birds) and the highest in September (25 birds). Stilt numbers were lower than in recent years. Coot numbers ranged from 11 to 18. The high coot count for the unit was 21 on May 30. Moorhen sightings ranged from 1 to 2 during the year, mostly in pond 1. The Hawaiian duck was only sighted occasionally, with numbers ranging from 2 to 4. Stilt and coot nests and young were observed on the refuge during the spring and early summer months.

Counts on these units can be variable due to conditions on and off the refuge. Waterbirds may be drawn to the Waipio



Coot and stilt numbers at Waiawa, 1985.



Coot and stilt numbers at Honouliuli, 1985.

Peninsula or other areas if wet weather creates more habitat.

### 3. Waterfowl

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

Waiawa Unit waterfowl observations:

October - 2 northern shoveler, 3 green-wing teal, 10 unidentified ducks

Honouliuli Unit waterfowl observations:

January - 4 northern shovelers, 5 am. wigeons, 1 blue-winged teal

February - 40-48 pintail, 9 shoveler

March - 8 shoveler

April - 6 shoveler

December - 2 unidentified duck

### 4. Marsh and Waterbirds

WAIAWA UNIT:

The native black-crowned night heron was commonly seen on this unit throughout the year. Heron numbers averaged 3 to 10. High fish populations and drawdowns during the year attracted more herons to this unit. These birds were believed to be associated with a small rookery less than one mile away on the north side of Pearl Harbor's west loch.

Cattle egrets were less numerous. Counts averaged between 1 and 3.

HONOULIULI UNIT:

Higher numbers of black-crowned night heron were also recorded at this unit. The average count was 7, and peak counts of 66 and 23 occurred during the months of January and February, respectively.

Cattle egrets were more numerous on this unit, with a peak count of 10 in January.

A single white-faced ibis, which appeared to have decided to stay in Hawaii, was not seen on the refuge during 1985. The bird had been recorded several times on the refuge during past years. However, the ibis was observed at regular intervals in 1985 on the Waipio Peninsula, located between

both units of the refuge. This is a very unusual sighting for the Hawaiian Islands.

#### 5. Shorebirds, Gulls, Terns, and Allied Species

##### WAIAWA UNIT:

The Waiawa Unit contains more shorebird habitat and the following was observed: Lesser Pacific golden plover--3 to 68; ruddy turnstone--5 to 18 (was observed every month except March, May, and June); wandering tattler--2 to 7 (observed throughout the year); and sanderling--1 to 8. One semi-palmated plover was observed on October 10.

##### HONOULIULI UNIT:

The following shorebirds were observed at the Honouliuli Unit: Lesser Pacific golden plover--15 to 60; ruddy turnstone--1 to 7; wandering tattler--1 to 6 (observed most of the year); sanderling--2 and 3 observed in April and May, respectively); long-billed dowitcher--5 to 6 observed in January and February, respectively).

#### 6. Raptors

A lone osprey has also taken up residence 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. It was frequently observed roosting on a dead snag in the oceanside pond. This bird was observed once in August at the Honouliuli Unit.

#### 11. Fisheries Resources

Adult milkfish and mullet were collected in the Waiawa Unit during the month of March for Hawaii Oceanic Institute's hormone research on captive propagation of this species. The milkfish collected were compared with data from fish collected the previous year in the same unit. The Institute seined 214 milkfish and 68 mullet from the pond. The fry of milkfish, as well as mullet, are free to enter the refuge through the screened outlet to the harbor.

The two drawdowns of the year greatly set back the overabundance of tilapia, mullet, and milkfish that inhabited the Waiawa Unit. This abundant fish population has had a negative impact on the invertebrate population within the unit.



An osprey was frequently observed at the Waiawa Unit. This is a rare sighting for Hawaii. SB



Hawaii Oceanic Institute personnel seining milkfish and mullet from the Waiawa Unit. JK

## 15. Animal Control

Live traps were set by YCC during summer months to catch mongoose, dogs, 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-five trap nights captured 13 mongoose and one cat. The cat was turned over to the Hawaiian Humane Society.



Mongoose were trapped during the spring and early summer months at Pearl Harbor NWR. SB

## 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 and lesson plans designed to maximize the learning experience during subsequent brief visits by school groups. Budget and staff limitations have thus far limited such activity.

## 6. Interpretive Exhibits/Demonstrations

In February, Dick Kuehner and Chris Holden, Regional Office I&R Specialists, along with Leinecke and Krakowski, reviewed the refuge public use plan. Interpretive exhibits, observation areas, and signs were discussed for Pearl Harbor NWR. Entrance and interpretive signs were specifically planned.

## 11. Wildlife Observation

Two individual bird watchers received permits to visit the refuge throughout 1985. Their time requires less than 50 hours of use per year and their observations greatly enhance 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 repaired after each incident. The Waiawa Unit is only 25 acres in size, therefore trespass cannot be tolerated.

# I. EQUIPMENT AND FACILITIES

## 2. Rehabilitation

Ron's Construction was awarded a \$29K ARMM contract to rehabilitate the nesting islands at the Waiawa Unit. This was a heavy equipment rental contract that started on August 8 and ran through September 18. The company used two, 450 John Deere dozers with backhoes for the job. The contract called for reducing the size of the nesting islands, expanding the perimeter moat, and extending a road that would cut the unit in two. Mike Poe, RO-EN served as contract inspector August 8 through August 23. He was present for most of the grading and island creation. Additional shaping of the islands was accomplished by refuge staff during the month of September.

Two types of islands were carved out of the large islands. Excess material from the previous islands was spread over the surface of the unit or removed from the unit. Limited equipment rental hours prevented total removal of excess fill from the unit. The heavy equipment would not work in the deep area of the mountainside pond, which retained water

through the construction period. Forty large islands were gradually shaped to an elevation of at least 2.9' msl. These islands will serve as windbreaks for the smaller islands and substrate for emergent vegetation. This area receives 10-15 mph. winds on a frequent basis. These winds create waves that erode islands. The refuge plans to plant desired emergent vegetation on the windward slopes of the large islands to further protect both island types. This emergent vegetation will also be used by nesting coots and foraging moorhens (if we can freshen the ponds). Two to three small (4 to 6 feet in diameter) islands, with an elevation of 2.0' msl., were created adjacent to the large island's leeward side. These were created for stilt nesting habitat. Most of the bottom of both ponds varies between 1.7 and 1.3' msl. Deeper areas (1.0 to -1' msl) were left in the ponds for submergent plant growth. A 5 to 8 foot wide moat was excavated to at least a depth of -1.0' msl. around both ponds.

The refuge plans to flood these small islands from September to March of each year to prevent vegetation from getting established on them. Starting in March, the ponds will be incrementally lowered to expose the small islands and add more brood habitat as the stilt nesting season progresses.



Ron's Construction used a JD 450 dozer to break up the larger islands of the Waiawa Unit. JK



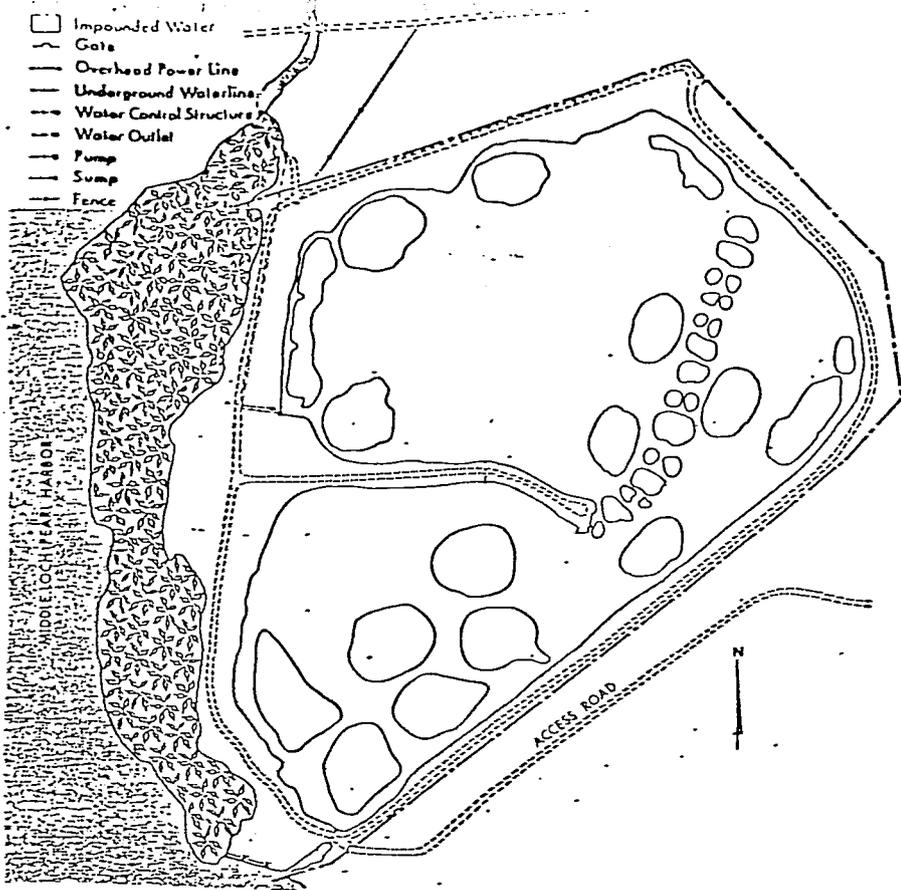
In the dry areas of Waiawa, the front bucket of the JD 450 could be used to excavate the moat. JK



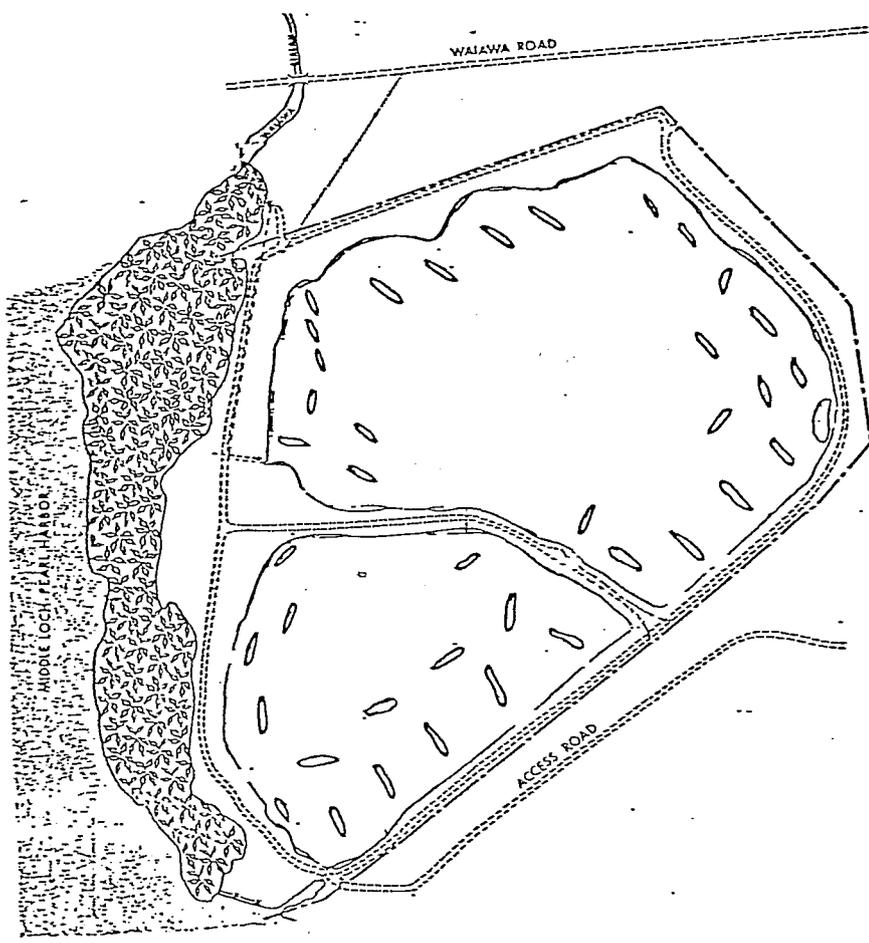
In the wetter areas, the backhoe had to be used to excavate the moat. JK



The Waiawa Unit road was extended to bisect the upper and lower ponds. Gravel was added to the surface. This picture was taken in December--the unit is full of water and the small islands are submerged. JK



WAIAWA UNIT BEFORE 1985 CONSTRUCTION WORK



WAIAWA UNIT AFTER 1985 CONSTRUCTION, LARGE ISLANDS ONLY

### 3. Major Maintenance

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

### 4. Equipment Utilization and Replacement

The John Deere 302 tractor is stored at the Navy storage yard located adjacent to the Waiawa Unit. Rehabilitation of the tractor hydraulic system took place in 1985.

## 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 and its implements are stored in this secure location. They also provide us with some additional enclosed storage for fencing and other hardware materials.

### 4. Credits

Jim Krakowski wrote the narrative.

KAKAHAIA NWR  
Molokai, Hawaii

ANNUAL NARRATIVE REPORT  
Calendar Year 1985

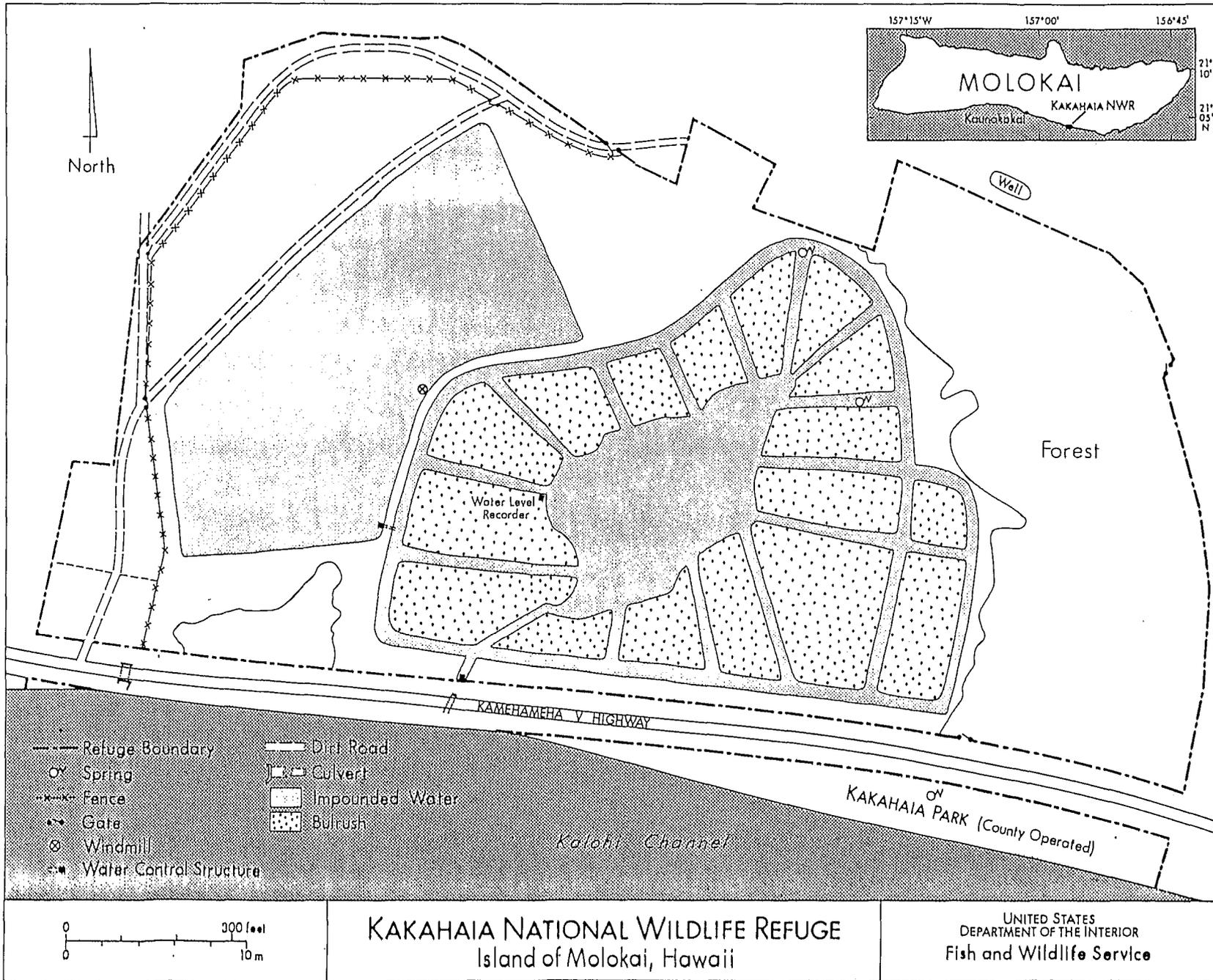
U.S. Department of the Interior  
Fish and Wildlife Service  
NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

Kakahaia NWR is a coastal freshwater pond, formerly used as a 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, additional shallow water habitat was added to the refuge, which provided habitat for the endangered stilt. The refuge is surrounded by kiawe 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 NWR's main pond (bulrush pond) in 1983, just after the Menzi Muck excavated channels through the bulrush. Refuge files photo.



KAKAHAIA NATIONAL WILDLIFE REFUGE

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## A. HIGHLIGHTS

Problems with the windmill and its pumps prevent desired water level management in the new pond (Section F.2). There was a decrease in coot numbers in 1985 (Section G.2). A black brant, canvasback, and great blue heron were observed on the refuge (Sections G.3 and G.4). Vili Oto was awarded a \$7.8K contract to clear brush from the refuge perimeter moat and fenceline (Section I.3).

## 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 similar to those reported for the Honolulu Weather Observation Station.

The refuge is located on the leeward side of the island of Molokai. The refuge annually receives 20-30 inches of rain. Occasional storms will cause flooding in coastal areas near the refuge.

The months of January thru March were very dry on Molokai, with very little wind. The 5-acre shallow impoundment was less than full as a result.

## 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. It is presently 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

Ben Henderson, manager at the Paniolo Hale on Molokai, has purchased a lot north of the refuge. He requested and was given permission to use the right-of-way that travels through the northern portion of the refuge. Mr. Henderson was told that improvement (gravel, concrete, fill etc.) of the easement would never be allowed. He indicated that after retirement he may build a home back in this isolated lot. This lot is frequently flooded during heavy periods of rain. This flood water drains through the refuge and out to sea. No doubt, Mr. Henderson will be requesting the Service to attempt to create improved flood drainages and improved access once he moves to the lot.

This easement along the northern boundary of the refuge was cleared by Mr. Henderson of heavy brush during the year.

## 3. Other

PIA Marmelstein delivered the refuge revenue sharing check for Kakahaia NWR to Maui Mayor Tavares on 2/27/85. The \$5,450 check was based on .75% of the appraised fee value.

## E. ADMINISTRATION

### 1. Personnel

Kakahaia NWR is an unmanned station. Normally, Maintenance worker Woodside visits the refuge once a month to census birds, do light maintenance, and check water conditions.

### 5. Funding

The Wetland Refuges budget is allocated by the Hawaiian Islands Complex Manager. The FY budget for the Oahu and Molokai refuges was as follows:

|                     |                |
|---------------------|----------------|
| Travel              | \$ 6.0K        |
| Administration      | 2.3K           |
| O&M                 | 12.3K          |
| Large ARMM Projects | 31.0K          |
| Small ARMM Projects | 5.5K           |
| RPRP Projects       | 17.5K          |
| TOTAL               | <u>\$74.6K</u> |

The ARMM and RPRP projects included maintenance dollars for the Kakahaia NWR fence and windmill operation that could not have been accomplished with O&M dollars.

## F. HABITAT MANAGEMENT

### 1. General

This 44.6 acre refuge consists of a centrally located 15 acre spring-fed wetland area which at one time was an ancient Hawaiian fishpond. Later it was used for rice and taro cultivation. Presently, the wetland area is bordered by a two-lane highway to the south and surrounded by a scrub forest (22 acres) on 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 covers 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.

The refuge expanded the waterbird habitat by completing two projects during the summer of 1983: (1) the 11-acre bulrush stand was 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 will be pumped from the spring-fed, 15 acre wetland to the new impoundment.

## THE 5.5 ACRE WATER IMPOUNDMENT

Ideally, the refuge would like to maintain high water levels from October through early March in the new impoundment. This would increase the habitat for wintering waterfowl and coots. In March, the pond would be drawn down to provide stilt nesting and feeding habitat. Water levels would be held at March levels or drawn down slightly to provide additional stilt brood habitat through the month of August. The entire month of September would be available for the slow build up of the pond to the desired high winter water level.

We have yet to learn the full pumping capabilities of the windmill. Four pumps can be used by the windmill, but this may cause excessive stress. In addition, winds vary with seasons, and light winter winds frequently cannot power any pumps when all four are attached. With infrequent monitoring it is difficult to determine optimum pumping strategy for this system.



Maintenance worker Woodside has spent many hours working out the "bugs" of the Kakahaia NWR windmill. JK

In 1985, there were difficulties in maintaining optimum water levels in the 5.5 acre shallow water impoundment. All four of the windmill's six-inch water pumps were used during the months of January, February, March, and April.

However, problems with pump rod bolts temporarily put the pumps out of commission during January and March. The pond was 6 inches below the desired level for the January through mid-March period. Finally, by the last week in March, the pond reached the desired winter water level with all four pumps working. Woodside disconnected two of the pumps on April 5 with the advent of the strong trade winds. The two pumps worked quite well for the months of April, May, and June, maintaining the pond 1-2 inches below the winter level. In July, a pump rod-piston disconnection, caused the pond to drop 7-5/8 inches below the winter level; a much greater drop than desired. We continued to use only two pumps and the water level rose to 4 inches below winter level by September. The two pumps raised the pond another 2 inches by October. However, November and December were months that lacked wind and the pond remained 2 inches below the desired winter water level. In January, we plan to use all four pumps to utilize as much of the wind as possible.



Despite the difficulties in maintaining water levels in the new pond, a healthy stand of Potamogeton flourished within 1/3 of the pond, providing ample food for coots and waterfowl.  
JK

## KAKAHAIA BULRUSH POND

We discovered that the 1983 BLHP channel project has some drawbacks. Spoil dikes from the channels created dry land areas in the wetland and Pluchea sp. has grown on these dikes. This plant is difficult to control. Also, the channel is not wide enough; bulrush and Brachiaria sp. are starting to creep across the channels. The refuge is planning another project to widen these channels and remove the dike material from the wetland.

The culvert leading under the highway drains the main wetland. Although the county normally maintains this culvert, it remained plugged with sand throughout the year. However, the refuge has no complaints; due to a leak in the flashboard/culvert system, we preferred to have the drain plugged. The Kakahaia pond levels were quite variable for 1985 (see table below). High water levels were recorded during the winter months. However, a very dry summer dropped the pond to very low levels during the September-October period. During a heavy rain on October 17, the pond rose from 2.45' to 4.04' in 24 hours. (See table on following page.)

### 3. Forests

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

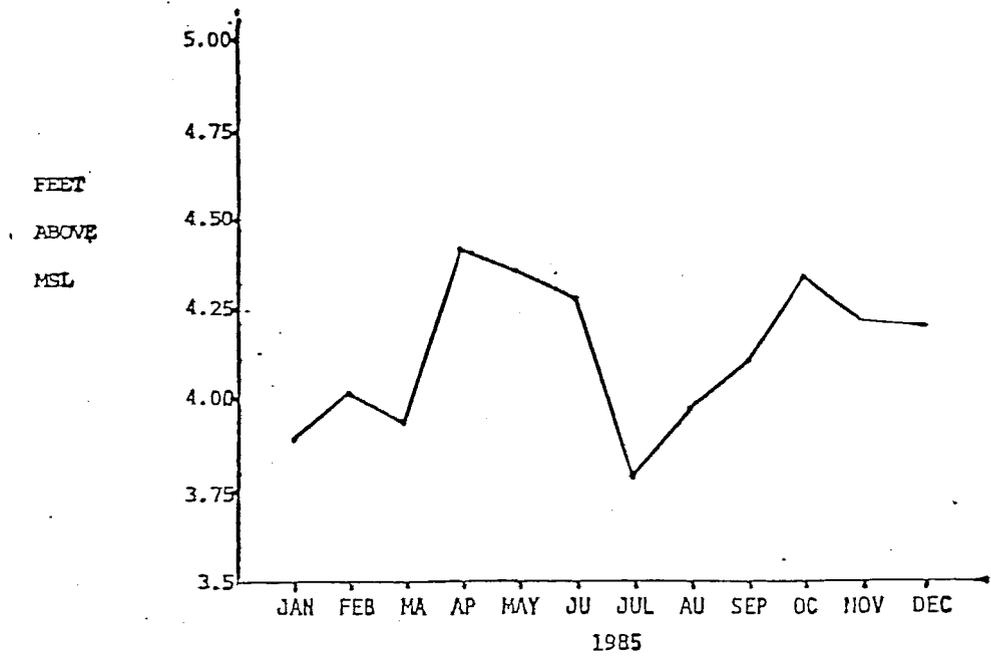
A contract was issued during 1983 to clear portions of this vegetation that was encroaching on the boundary fence (Sec. I.3).

### 10. Pest Control

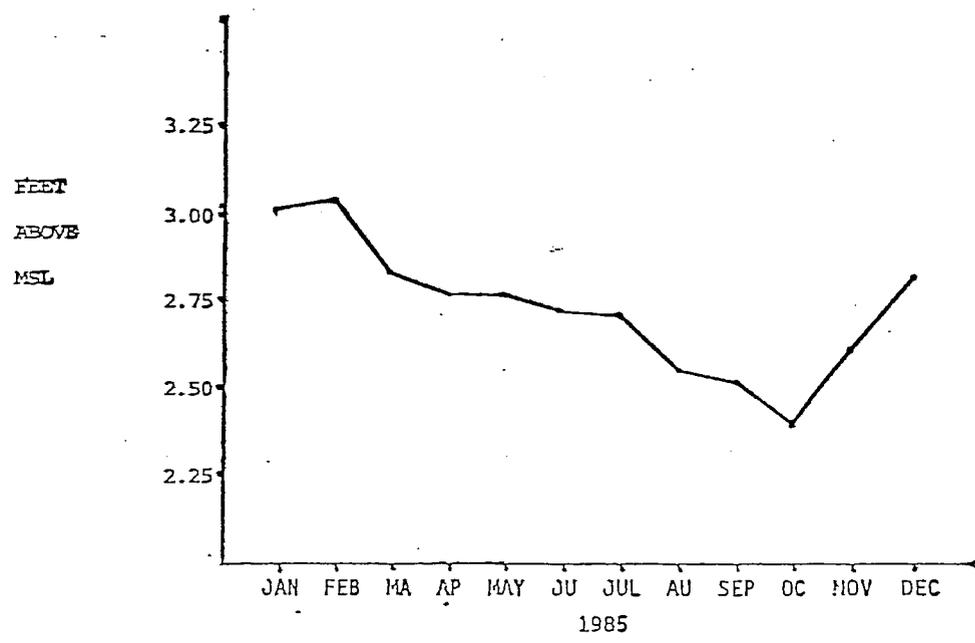
In October, Woodside coordinated Rodeo spraying of approximately 2 acres of Echinochloa sp. in the shallow pond. George Dennison, a refuge neighbor, was contracted to do the work (at \$15/hour with herbicide supplied by the FWS). The Echinochloa was so rank it precluded waterbird use.

### 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



Water levels in new pond at Kakahaia NWR.



Water levels in the bulrush pond at Kakahaia NWR.

impacts to 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 during the year.



Echinocloa sp. is normally thought of as a beneficial food plant for waterfowl. At Kakahaia NWR, it grew too well and had to be controlled in 1985. JK

## G. WILDLIFE

### 2. Endangered Species

The Hawaiian coot and stilt are two endangered species normally encountered on the refuge. Monthly censuses of these species can be found in the table on the following page.

Coot populations were far below the counts of 150 observed in 1984. Coot populations of about 50 were observed during the first six months. Numbers further decreased after the month of June. January and June had the high counts of 63, while November and December had counts of 20 and 25 respectively. The reduced numbers are probably due to reduced habitat in the Kakahaia pond or movement of the birds to other wetlands. The new pond produced its first

coot nest (6 eggs) in May of this year. In the past, it was felt that coots nested exclusively on the floating algae of the deeper Kakahaia bulrush pond. Systematic nest surveys cannot be conducted, so nesting information is determined from incidental observations.

Stilt counts were variable throughout the year. The months of January, February, March, September, and October had counts of over 20 birds. A high of 31 stilts was counted in January. Stilt nests and young were observed during the months of May (1 nest) and June (3 nests with eggs, 5 young out of nest). (See table on following page.)

Six moorhen were released at Kakahaia NWR in 1983. These birds were transplanted from the island of Oahu. Molokai has not recorded moorhen for many years prior to this reintroduction. The six birds were neck collared with blue bands. Sightings after release have steadily decreased. In January and February 1984, two birds were observed, and in February one bird was seen; both sightings were on Kakahaia pond. This was the last record of the year, however. Hope diminished with the passage of time. Everyone was surprised in December of 1985 when one of the collared moorhen was observed in the new pond.

A single koloa was observed at Kakahaia NWR in June.

### 3. Waterfowl

Limited 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. (See table on following page.)

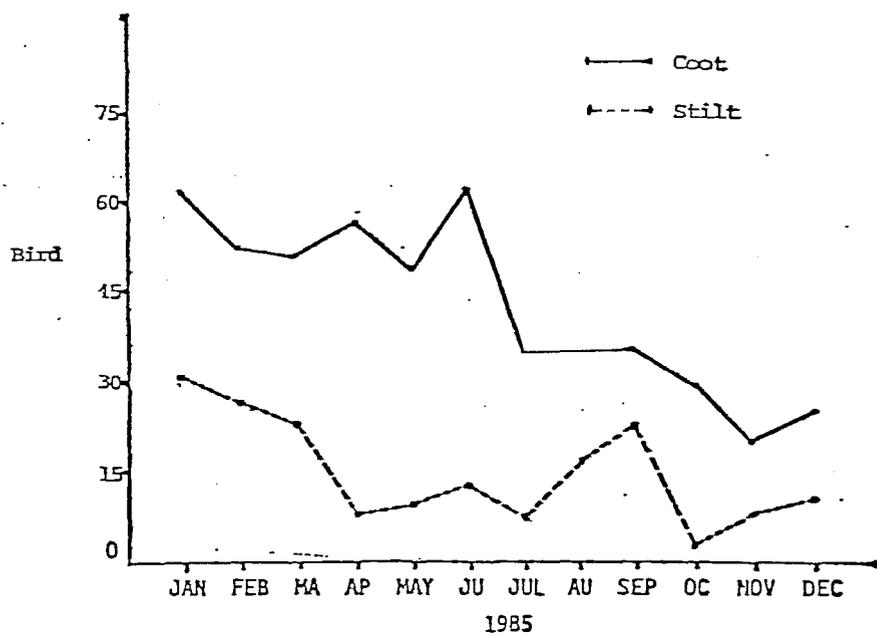
In December, a black brant and canvasback were observed on the refuge. These are both uncommon visitors to Hawaii.

### 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. Their numbers range from 3 to 6. No heron nesting was observed on the refuge during 1985.

Cattle egret numbers have been on the increase. A high count of 12 occurred in June.

On October 11, Woodside first observed a great blue heron on the refuge. This is an uncommon visitor to the islands. The bird was observed on the refuge during the months of October, November, and December.



Coot and Stilt numbers at Kakahaia NWR, 1985.

MONTHLY WATERFOWL CENSUS - 1985

| Month     | Shoveler | Gr-wg Teal | Am. Wigeon | Gadwall | Pintail | Scaup | E. Wigeon |
|-----------|----------|------------|------------|---------|---------|-------|-----------|
| January   | 0        | 3          | 7          | 2       | 18      | 0     | 1         |
| February  | 2        | 0          | 5          | 3       | 15      | 0     | 3         |
| March     | 5        | 2          | 3          | 3       | 4       | 0     | 2         |
| April     | 8        | 0          | 4          | 0       | 0       | 0     | 0         |
| May       |          |            |            |         |         |       |           |
| September | 2        |            |            |         |         |       |           |
| October   | 6        | 0          | 4          | 0       | 20      | 0     | 0         |
| November  | 8        | 0          | 0          | 0       | 1       | 1     | 1         |
| December  | 29       | 3          | 8          | 0       | 6       | 1     | 0         |



A black brant was a rare winter visitor to Kakahaia NWR during the winter of 1985-86. JK

#### 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 fall, winter, and spring months. Common species include: lesser golden plover (8-10), ruddy turnstone (20-30), sanderling (20-30), and tattler (1-4).

One lesser yellowlegs was observed during the month of February.

#### 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 water regularly at the bulrush pond.

## 15. Animal Control

Mongoose are quite numerous on the island of Molokai. Normally the refuge traps these animals on the endangered waterbird refuges; however, time and manpower constraints prevented trapping on Kakahaia NWR in 1985. The refuge had been investigating the possibility of contracting the trapping in 1985, with no success.

There were about six dogs that had been visiting the refuge on a frequent basis. Some had collars and the suspected dog owners were warned by Woodside of current leash laws and the negative impact of loose dogs on the refuge. The local dog catcher was also advised of the situation.

## H. PUBLIC USE

### 1. General

Kakahaia NWR is located 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.

### 6. Interpretive Exhibits/Demonstrations

In February, Dick Kuehner and Chris Holden, Regional Office I&R Specialists, along with Leinecke and Krakowski reviewed the refuge public use plans. Interpretive exhibits and signs for Kakahaia NWR were discussed. An entrance sign, parking area rehab, observation tower, and interpretive signs are specifically planned.

### 9. Fishing

Molokai residents fish from the beach along the Maui County park, which is under SUP from the refuge. Counts on park use are difficult to determine due to night fishing and our infrequent visits to the refuge.

### 14. Picnicking

A day-use picnic area was constructed in 1978 on the ocean-side of the highway intersecting the refuge, and it 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 picnic area.

### 17. Law Enforcement

On 6/14/85, an extra lock was discovered on the road gate leading to the windmill, and on the mauka (north) gate. Someone had cut the refuge chain and attached a lock on each gate for access through the refuge. All attempts to find the owners of the locks failed. The locks were removed from the chain, but left on the gate with a note requesting identification. The locks were still attached to the gate by year's end.

On 11/27/85, refuge neighbor George Dennison, informed refuge staff that Patterson Construction of Molokai damaged a portion of the refuge road as they moved equipment during the month of November. The Patterson Company was doing shrub clearing work and topsoil removal for another refuge neighbor, Mr. Parell. However, the land that was cleared apparently was leased to Dennison. Dennison stopped the clearing work after getting a court order and is attempting to sue Parell. These two have been feuding for many years. Dennison requested that the FWS demand that Patterson Construction make repairs on the refuge road. This is a dirt road with a light topping of gravel that frequently gets rutted during wet weather. The refuge has never maintained the road. It occasionally is graded by the County's highway crews. Krakowski contacted Mr. Patterson, who said that he did repair the road after leaving the site (November 7 and 8). Mr. Patterson said that recent rains had damaged the road. The road did not appear to be rutted beyond normal wet weather damage on a 12/3/85 inspection and the incident was no longer pursued by the refuge.

## 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. Woodside continues to modify and improve the 2-4 six inch pump assembly that is driven by the windmill.

### 3. Major Maintenance

The boundary fence of this refuge is subject to damage if

the shrub kiawe and hale koa are allowed to grow into it. Oto Vili, of Molokai was awarded a contract for \$4,000 to clear the brush from both sides of the fenceline. The refuge was very pleased with the results when his crew finished in October.

Mr. Vili also was awarded a contract of \$3,800 to clear and herbicide the perimeter dike around the bulrush pond. The Pluchea was over six feet in some areas of the perimeter dike. Mr. Vili's crew finished this job in November.

#### 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. Efforts to maximize water output of the windmill continue. However, the refuge may need to install an additional electric pump as a backup during periods of little wind.

#### 7. Other

Bob McVein, RO-Hydrologist, visited Kakahaia NWR on 7/11 with Woodside and Krakowski to check the water level recorder.

### 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

Krakowski wrote this narrative.

HAWAIIAN ISLANDS NWR

ANNUAL NARRATIVE REPORT

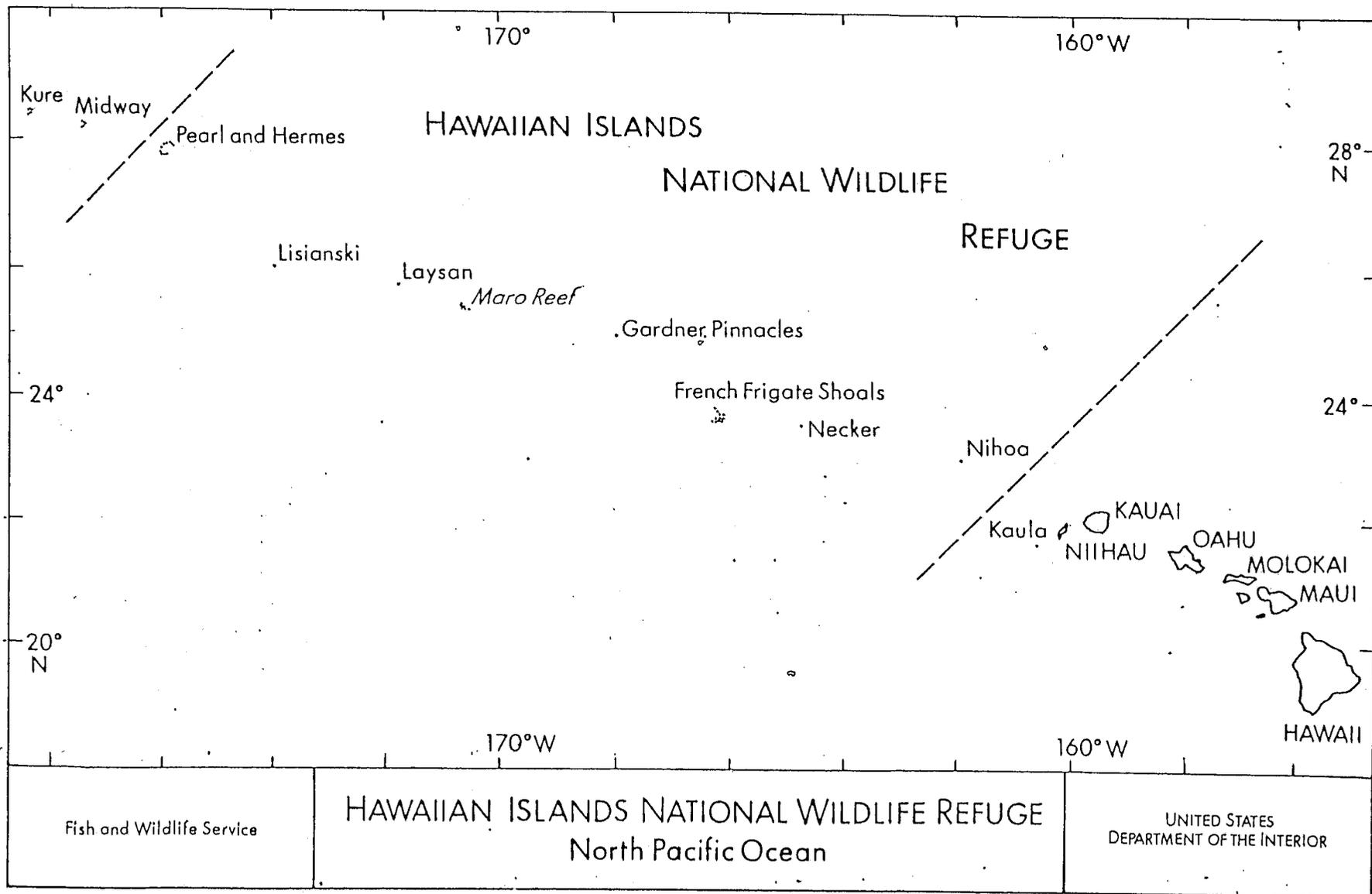
Calendar Year 1985

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

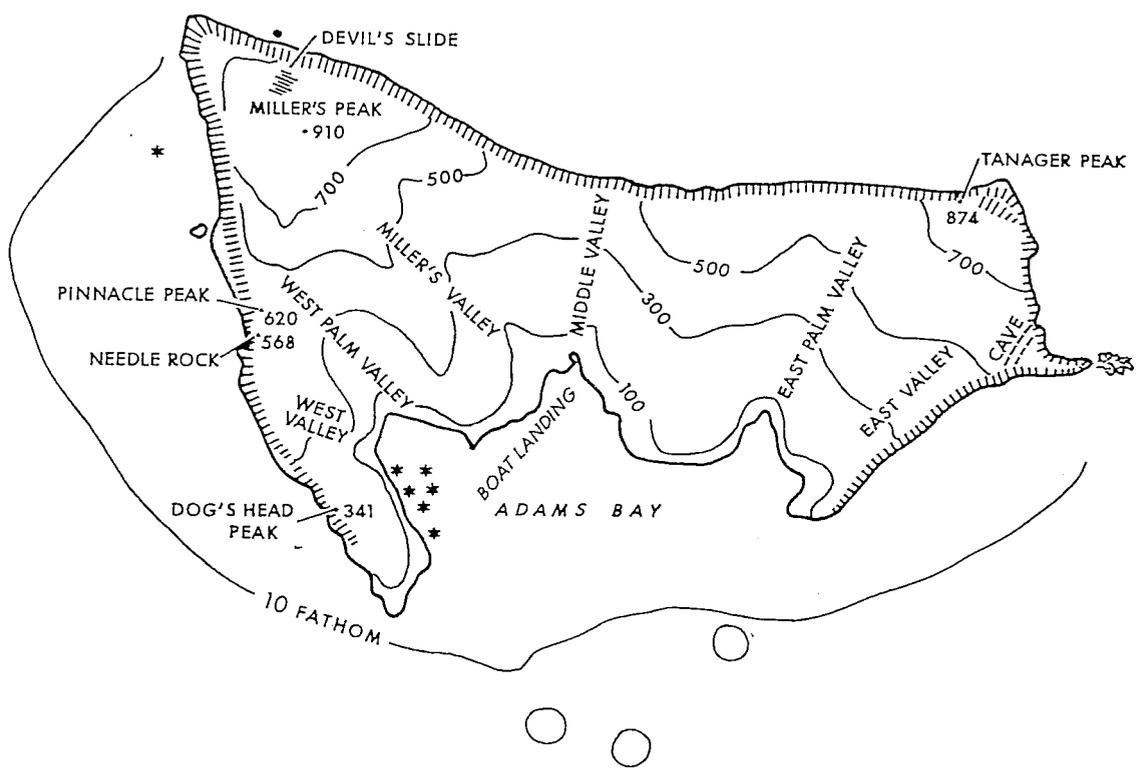
INTRODUCTION

The Hawaiian Islands National Wildlife Refuge (HINWR) consists of a chain of eight islands, reefs, and atolls extending about 800 miles in a northwesterly direction from the main Hawaiian Islands. Emergent lands total approximately 1,740 acres. The FWS considers another 242,700 acres of submerged land to be within the Refuge, though jurisdiction is contested by the State of Hawaii. Nihoa and Necker Islands, Gardner Pinnacles, and La Perouse Pinnacle at French Frigate Shoals are the cores of old volcanic cones. Sheer cliffs of basalt and the absence of beaches are typical of these islands. Laysan and Lisianski Islands are low, flat sand islands surrounded by submerged coral reefs. French Frigate Shoals and Pearl and Hermes Reef are typical coral atolls. Maro Reef has only a couple of small coral heads protruding a few feet above the surface of the ocean. Only one of the islands is presently inhabited. The FWS maintains a field station at Tern Island, French Frigate Shoals, manned year-round by two permanent employees and a handful of volunteers during the spring and summer.

Theodore Roosevelt established the Refuge in 1909 by Executive Order as a "preserve and breeding ground for native birds". Four endangered bird species (Laysan duck, Laysan finch, Nihoa finch, and Nihoa millerbird) breed on the islands along with 18 species of seabirds totalling about 14 million individuals. The refuge also supports the entire population of endangered Hawaiian monk seals, provides nesting beaches for the entire Hawaiian population of the threatened green sea turtle, and furnishes habitat for 13 candidate endangered plants, 32 candidate terrestrial invertebrates, and a diverse array of marine fishes and invertebrates.



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04'



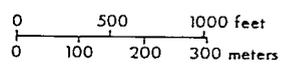
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LEGEND :

- ||||||| CLIFF
- CORAL REEF
- \* CORAL HEAD

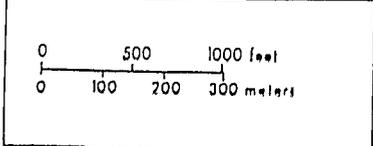
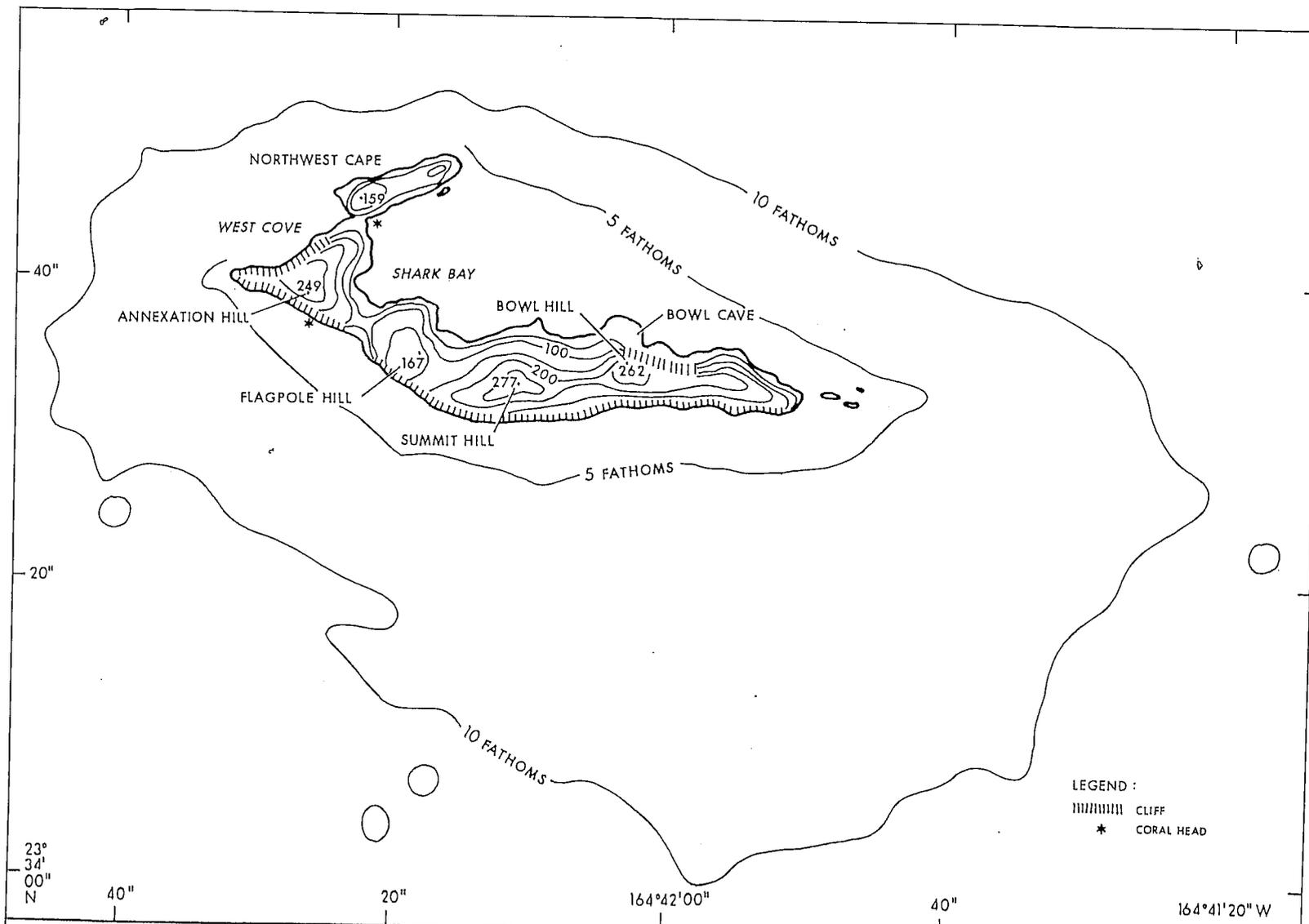
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161° 55'



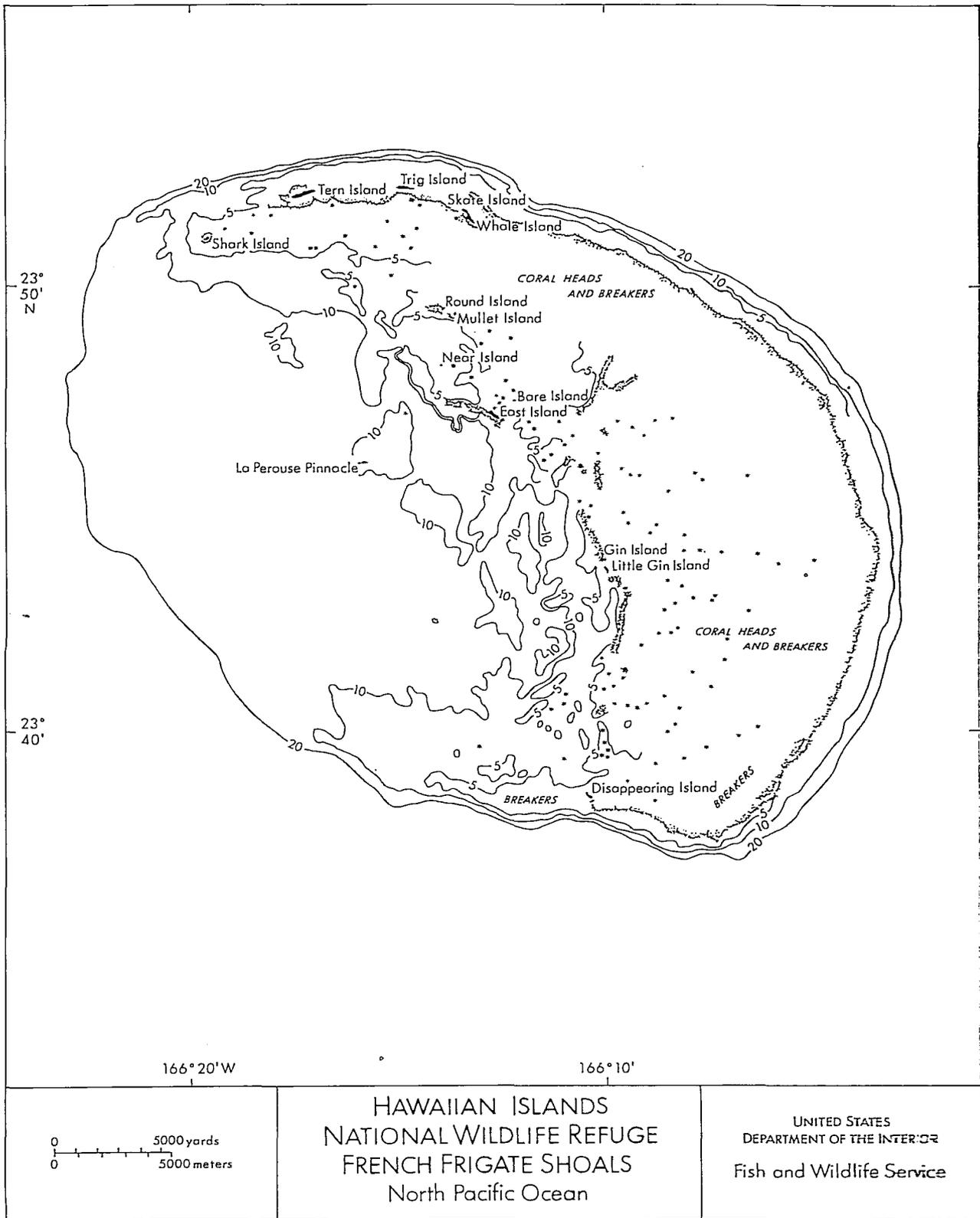
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 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service



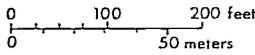
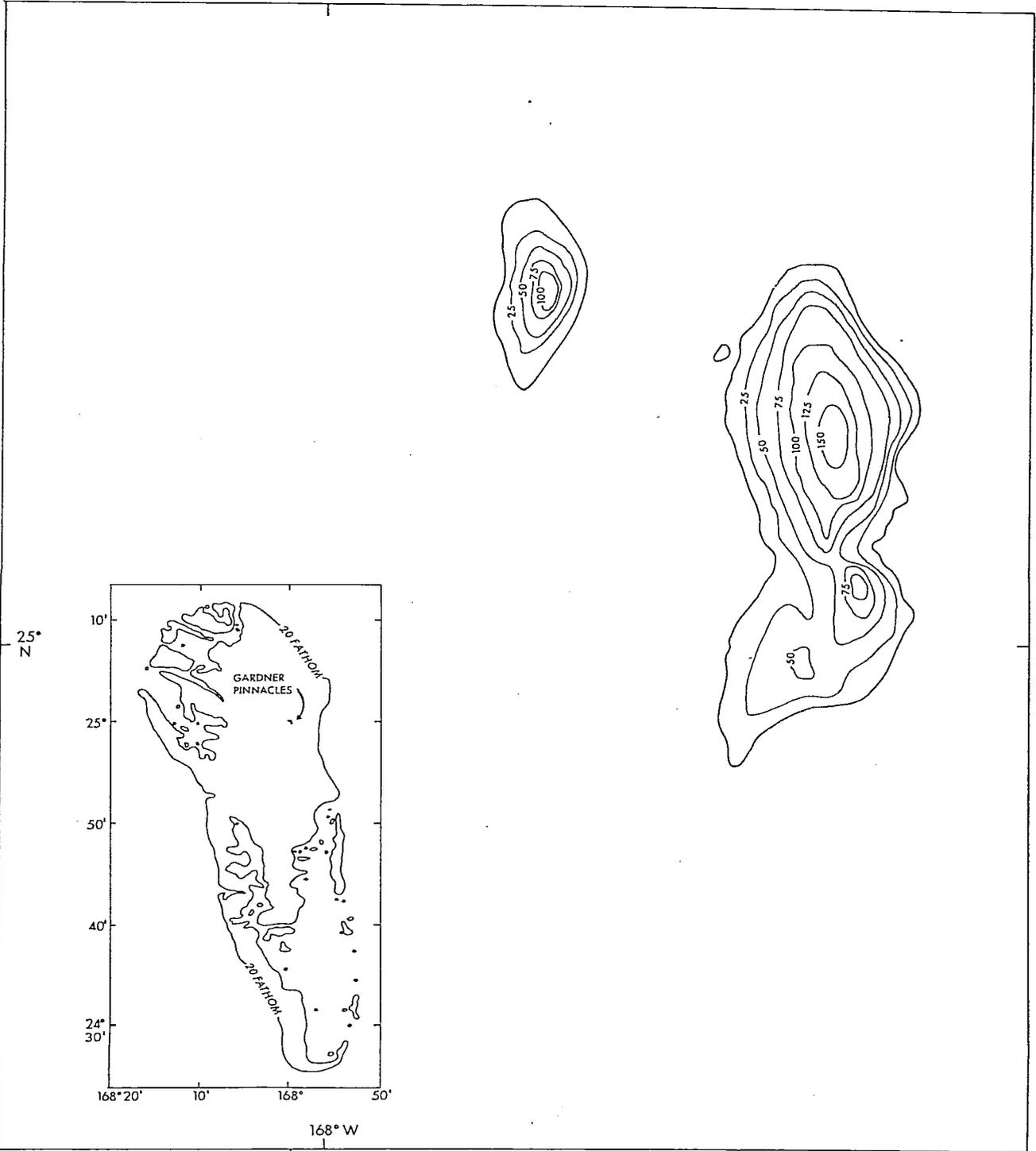
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 North Pacific Ocean

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 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service



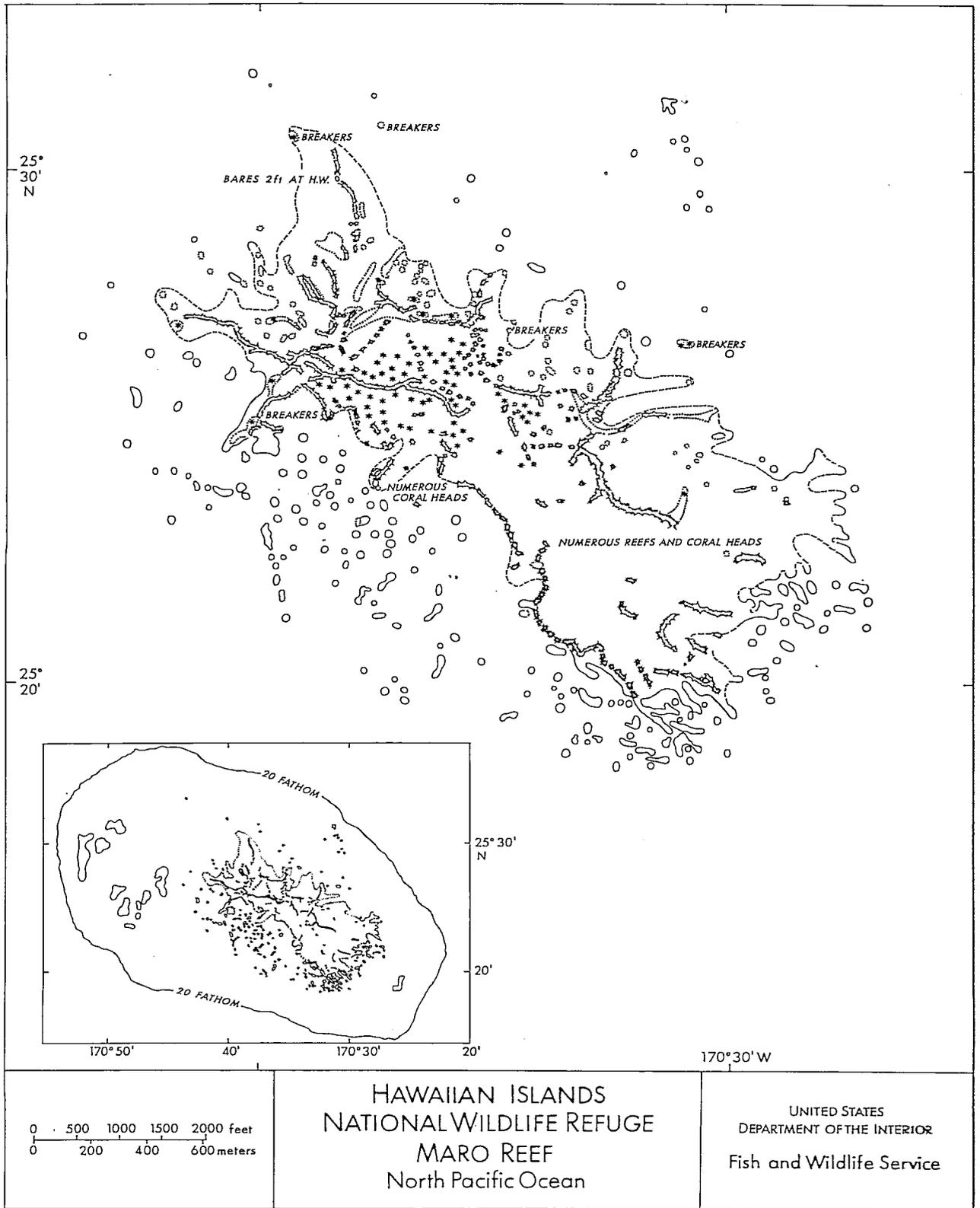
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 FRENCH FRIGATE SHOALS  
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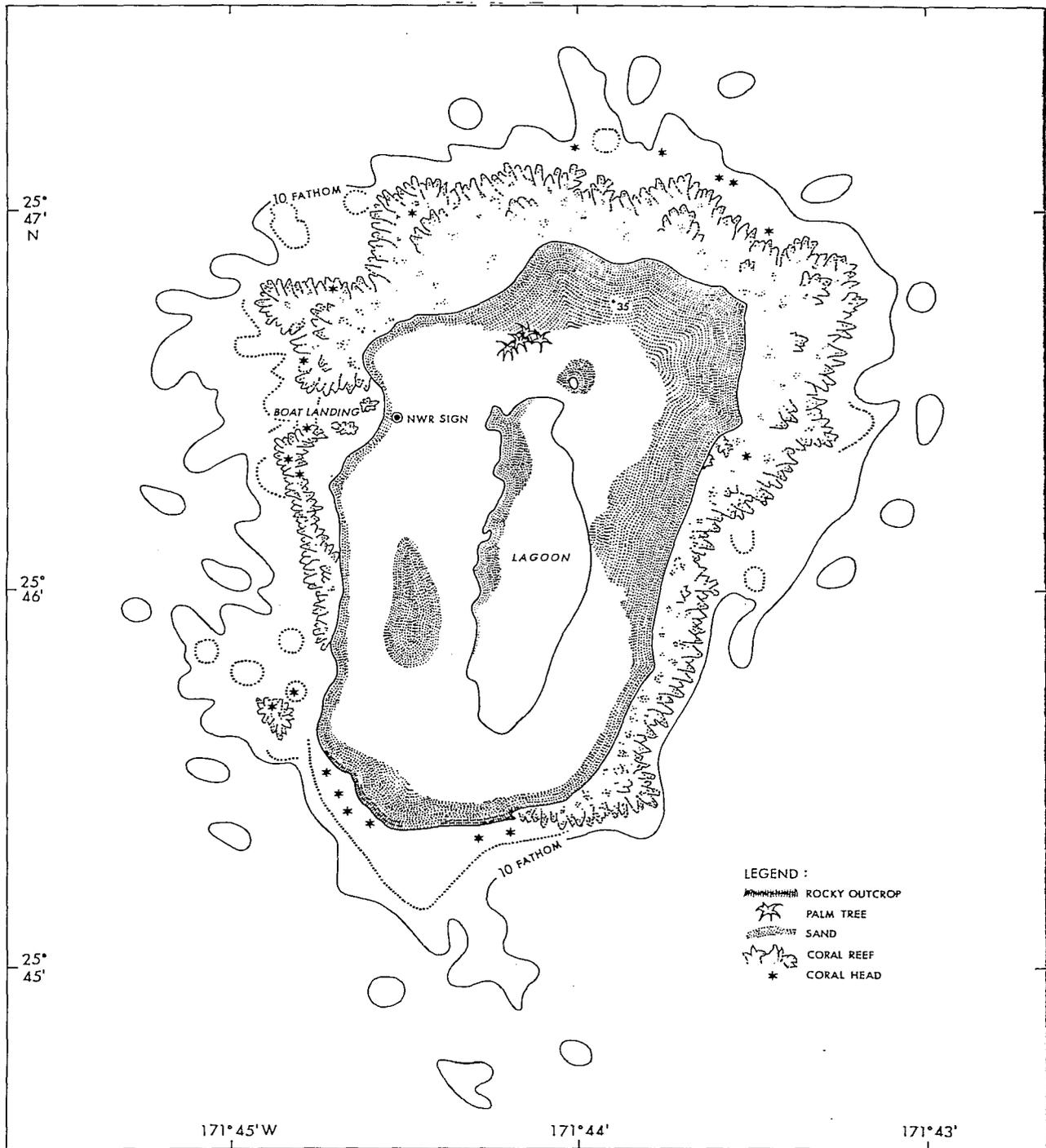
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 NATIONAL WILDLIFE REFUGE  
 GARDNER PINNACLES  
 North Pacific Ocean

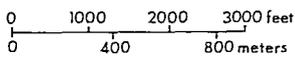
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 Fish and Wildlife Service

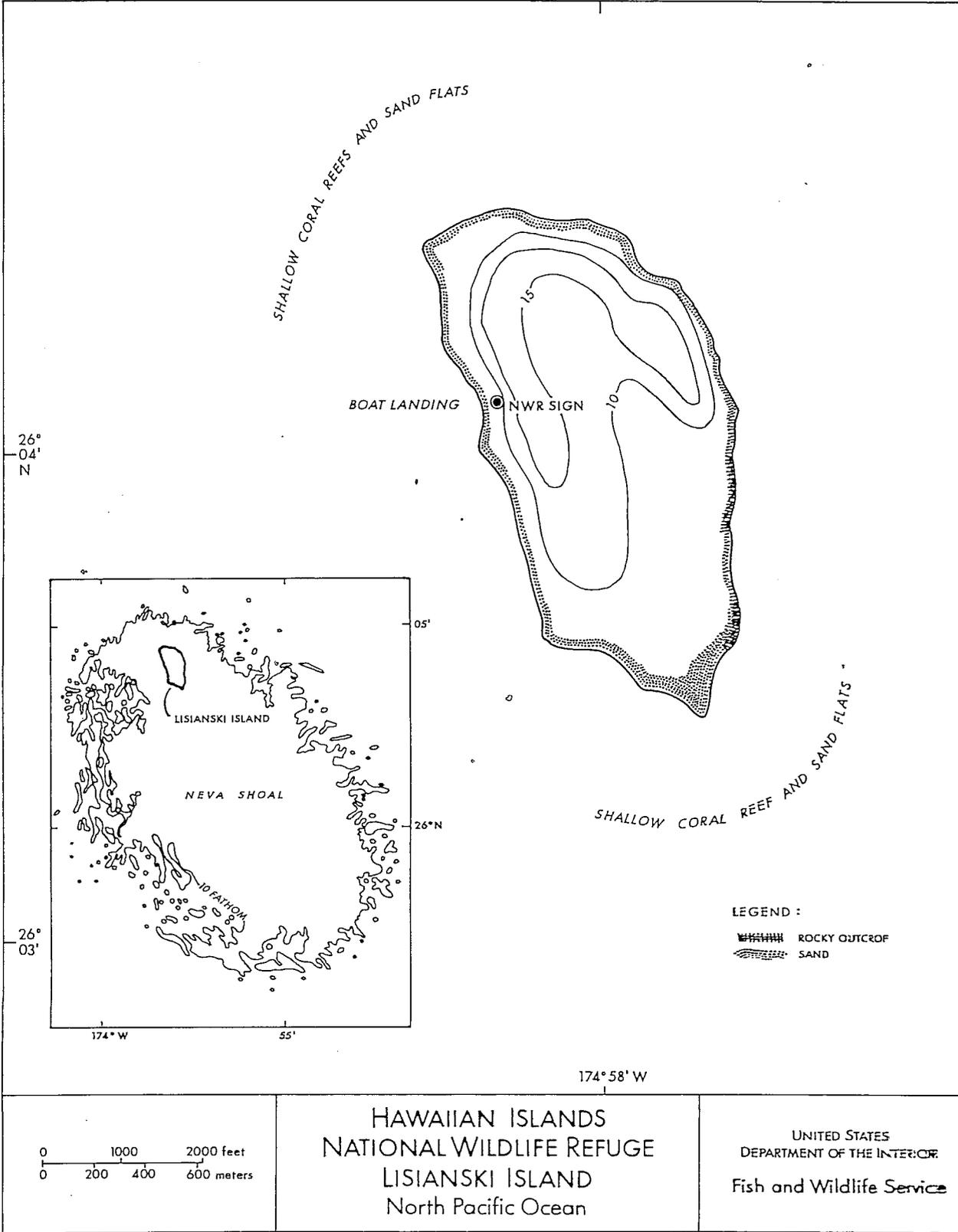


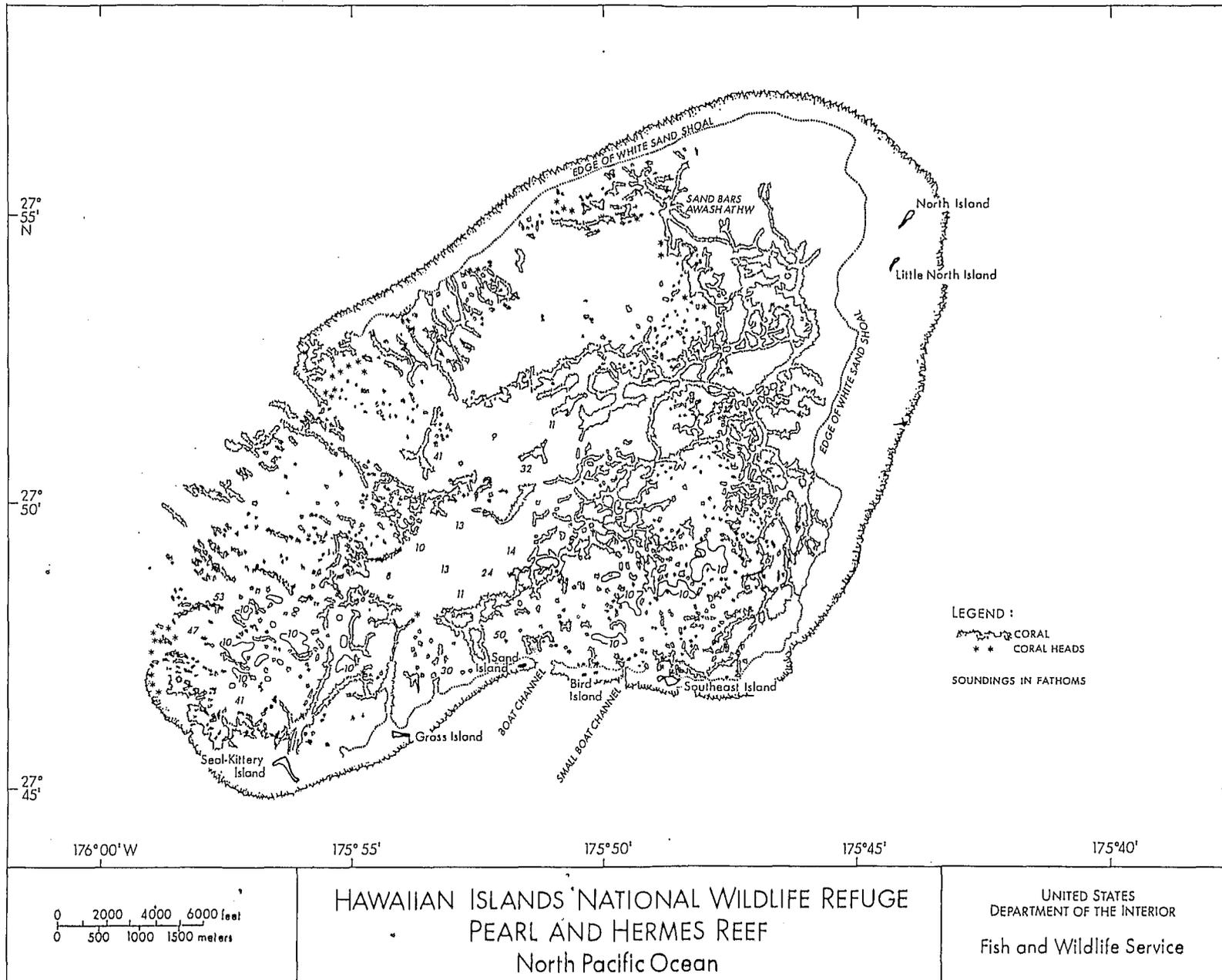


- LEGEND :
-  ROCKY OUTCROP
  -  PALM TREE
  -  SAND
  -  CORAL REEF
  -  CORAL HEAD

HAWAIIAN ISLANDS  
 NATIONAL WILDLIFE REFUGE  
 LAYSAN ISLAND







HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

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## A. HIGHLIGHTS

Hurricane Nele passed within 100 miles of Tern Island on October 28, causing strong winds and heavy precipitation (Section B).

On two separate occasions large ocean swells caused considerable damage to the seawall, vegetation, runway, and the nesting albatross (Sections B and F.6).

The Master Plan/Environmental Impact Statement for the Hawaiian Islands NWR was in review during the year. In May, Planning Update No. 5 was issued (Section D.1).

Record numbers of Hawaiian monk seals continue to be observed at Tern Island. On March 5, 1985, 181 individuals were observed hauled out on the beaches (Section D.5).

Sand dune fencing again occurred on Laysan Island. Volunteers and the U.S. Coast Guard were instrumental in the fence construction that will protect the Laysan lagoon (Section F.6).

Record numbers of great frigatebirds started to breed on the island (Section F.10).

Tern Island staff constructed a new boat dock and fuel pipeline (Section I.1).

The U.S. Coast Guard cutter SASSAFRAS delivered 10,000 gallons of diesel fuel to Tern Island (Section I.7).

The fishing vessel CAROLYN K struck the reef at French Frigate Shoals in February (Section J.3).

## B. CLIMATIC CONDITIONS

The portion of the Hawaiian archipelago included in the refuge extends from Nihoa Island (23°03'N., 161°55'W.) to Pearl and Hermes Reef (27°47'N., 175°49'W.). Weather conditions are variable because of the change in latitude, but are generally tropical to sub-tropical in nature with a fairly constant northeast tradewind blowing.

Weather data on Tern Island are collected by two methods for different purposes. The National Weather Service operates a remote weather station that transmits data to a satellite on an hourly basis. Since the data are only used for marine weather forecasting, no long-term records are maintained.

Refuge personnel collect long-term weather data on a daily basis.

The following data are from the 1985 station logs:

## 1985 WEATHER SUMMARY

|                 | Mean<br>Max (F) | Mean<br>Min. | Daily<br>Mean | Wind<br>Vel.(kt) | Precip.<br>(in.) |
|-----------------|-----------------|--------------|---------------|------------------|------------------|
| Jan.            | 76.3            | 68.0         | 72.2          | 15.7             | 2.79             |
| Feb.            | 75.4            | 68.2         | 71.8          | 11.8             | 7.45             |
| Mar.            | 77.1            | 68.5         | 72.8          | 17.2             | 1.67             |
| Apr.            | 77.3            | 69.0         | 73.2          | 15.0             | 1.04             |
| May             | 79.4            | 69.9         | 74.7          | 15.0             | 1.75             |
| Jun.            | 83.3            | 73.3         | 78.3          | 9.2              | .28              |
| Jul.            | 83.8            | 73.7         | 78.8          | 13.0             | 2.44             |
| Aug.            | 84.9            | 75.3         | 80.1          | 12.6             | 2.12             |
| Sep.            | 85.4            | 75.3         | 80.4          | 11.2             | 1.30             |
| Oct.            | 83.5            | 74.5         | 79.0          | 13.4*            | 6.46             |
| Nov.            | 78.9            | 70.7         | 74.8          | 14.0             | 3.61             |
| Dec.            | 78.1            | 69.4         | 73.8          | 11.4             | 2.12             |
| Monthly<br>Mean | 80.3            | 71.3         | 75.8          | 13.3*            | 2.75             |

Total Precipitation (in inches) = 33.03

\* Excluding Hurricane Nele

The mean temperature for 1985 was 75.8°F, the mean maximum was 80.3°F and the mean minimum was 71.3°F. The coolest month was January, with an average minimum temperature of 68.0°F. September was the hottest month, with an average maximum of 85.4°F. The warmest day of the year was recorded on August 23, at 88.6°F, while the coolest was on February 4, at 61.0°F.

Winds averaged 13.3 knots, excluding a few wild days (October 28 and 29), when Hurricane Nele was in the area. Generally, the northeast tradewinds were mild to moderate during the months of March through November, and the remaining months were variable, relating to distant storms.

Precipitation in 1985 was 33.03 inches. Nearly 5 inches of rain fell during Nele's passage and 7.45 inches of rainfall were recorded in February. June had the least precipitation with a 0.28 inch recorded.

The latter part of 1985 proved to be an eventful period with the occurrence of a hurricane and large waves that swept over Tern Island. On October 28, Hurricane Nele passed within 100 miles of Tern Island. Wind gusts up to 69 knots, with sustained winds of 50 knots were recorded.

On December 9 and 20, large ocean swells produced by distant storms washed over the runway and battered the seawall on the north side of the island. The waves were estimated at 25 to 30 feet as they hit the protective reef 500 yards offshore. On December 20, the remnants of a 40 foot wave crashed across the reef and over the seawall, sending a 2-foot wave over most of Tern Island. Considerable damage occurred to the seawall, vegetation, albatross nests, and the runway. Several tons of loose coral, with some pieces weighing 150 pounds or more, were deposited over most of the runway. Fortunately, tides were not at the maximum during the height of the storm.



Debris deposited on the runway at Tern Island by large waves which overwashed the island in December. RTV

## D. PLANNING

### 1. Master Plan

Formal Master Planning for the refuge began in 1983. The Draft Master Plan/Environmental Impact Statement for the Hawaiian Islands National Wildlife Refuge was released for public review and comment August 31, 1984.

Based on comments made during the second public workshop held September 12, 1984, and contained in 26 letters of comment received from various agencies and individuals, the Plan was revised and submitted to the National Marine Fisheries Service (NMFS) for Section 7 (Endangered Species) review on February 27. In May, over 400 copies of Planning Update No. 5 were mailed to agencies and individuals to inform them of the current status of the planning effort.

The NMFS Section 7 review, received in mid-August, concluded that two of the Preferred Alternative management strategies would jeopardize the continued existence of the Hawaiian monk seal and the Hawaiian population of green sea turtles. These were the proposals to provide recreational opportunity, storage space, and aircraft use at Tern Island in support of commercial fisheries and to facilitate limited, supervised photography, journalism and art (PJA) visits to the HINWR.

The fishery support strategy was subsequently dropped from the Preferred Alternative. The strategy to facilitate PJA visits was rewritten to permit such activities under strictly controlled, regulated, and supervised conditions. PJA activities would be seasonally and geographically restricted to limit disturbance on pupping and nesting beaches. Party size and the annual number of PJA visits would also be severely limited.

The Section 7 Consultation with NMFS was re-initiated on September 13 to address the revised PJA strategy. A "no jeopardy" opinion is anticipated early in 1986. Shortly thereafter, the Plan will be circulated for a 30-day review period. Assuming no substantive adverse comments are received, it will then be finalized and a Record of Decision filed. As resources become available, the high priority management strategies in the Preferred Alternative will be implemented.

### 4. Compliance with Environmental and Cultural Resource Mandates

A Cooperative Agreement between the FWS and the Bernice P. Bishop Museum, Honolulu, was signed in June of 1984 for the purpose of gathering data to facilitate management of

prehistoric cultural resources of the HINWR. Under this agreement, archaeological research was conducted on the islands of Nihoa and Necker in 1984 by Dr. Paul Cleghorn and Mr. Eric Komori. Late in 1984, Dr. Cleghorn submitted the first draft of his report describing the archaeological sites and their significance, discussing the prehistory of the islands and recommending management strategies for study and preservation of the resources. He also drafted nomination forms to place Nihoa and Necker Islands on the National Register of Historic Places. Revision of these drafts was delayed by a one-year sabbatical in New Zealand, but Dr. Cleghorn has returned to Honolulu and final copies of the report and nomination forms are expected this Spring.

##### 5. Research and Investigation

Refuge staff continued to coordinate numerous research projects in the Hawaiian Islands NWR conducted by a variety of agencies and personnel. Tern Island continued to be a focal point for studies of wildlife. Research efforts were also concentrated on Laysan Island where NMFS and FWS conducted a joint field camp. The field camp was operational on Laysan Island from March 2 to November 30. Refuge Biological Aide Bean participated in the field camp on Laysan Island from April 1 to July 21. NMFS also had field camps on Lisianski Island (June 17 to July 20) and on Pearl and Hermes Reef (June 19 to July 17). On Pearl and Hermes Reef, field camps were placed on Southeast Island and, for the first time, on North Island. An emergency supply site was also located on Seal-Kittery Island at Pearl and Hermes Reef. Biologists Fefer and Hu visited Nihoa Island, Laysan Island, Lisianski Island, and Pearl and Hermes Reef during an expedition to conduct biological surveys throughout the Hawaiian Islands NWR. Numerous volunteers also participated in studies at Tern Island and elsewhere and were instrumental in the biological program. FWS efforts focused on seabird monitoring and surveys of endangered land birds (Nihoa finch, Nihoa millerbird, Laysan finch (Laysan Island and Pearl and Hermes Reef) and the Laysan duck. NMFS research efforts continued on Hawaiian monk seals and green sea turtles. Cooperating scientists were involved in a variety of studies throughout the refuge. On September 19, a meeting was convened at the Honolulu Laboratory of the NMFS to review research studies in the Northwestern Hawaiian Islands. A number of researchers involved with fisheries, migratory birds, endangered landbirds, Laysan ducks, and other related studies and activities, described activities and preliminary results and outlined plans for 1986. A significant amount of effort was expended by refuge staff in Honolulu and on Tern Island in support of investigations having significant potential benefit to refuge resources.

The following research projects were conducted or continued in 1985:

#### HWN-1-85 Seabird Monitoring Studies

Seabird monitoring studies are conducted by refuge personnel annually in order to determine the status and health of the seabird populations in the Hawaiian Islands NWR. These data have been collected since 1979 on indicator species and are compared annually to determine if there are major differences in measured reproductive parameters which may indicate a change in environmental conditions due to natural or man-made causes. These data have proven valuable in determining the effects of the El Nino Southern Oscillation, which occurred in 1982/83 when anomalies in seabird breeding parameters in the Hawaiian Islands NWR were noted. The data may also be useful for measuring impacts of commercial fisheries in the vicinity of the refuge.



The weekly weigh-in of a red-tailed tropicbird chick is part of the chick growth study conducted at Tern Island. DKM

During 1985, population and phenology data were collected monthly on Tern Island and semi-annually (winter and spring/summer) from the other islands at French Frigate Shoals. Food habits data were collected weekly from black noddies and red-footed boobies on Tern Island. Red-footed booby, black noddy, and red-tailed tropicbird egg size,

reproductive success, and chick growth data were collected at Tern Island. The year-round presence of personnel on Tern Island continues to be instrumental to the seabird monitoring studies.



Assistant Refuge Manager Vetter "barfing" a red-footed booby to obtain a sample for the food habits study. RTV

Refuge staff joined a field camp on Laysan Island on April 1, and Biological Aid Bean participated in this camp and collected data on seabirds through July 21. Wildlife Biologist Hu accompanied Bean to Laysan Island and participated in setting up the studies. Egg size, reproductive success, and chick growth studies of black noddies, red-footed boobies, and red-tailed tropicbirds were initiated. However, the phenology of these species on Laysan Island in 1985 did not coincide with the period of the field camp. Black noddies nested relatively early, resulting in a lack of adequate nests at early stages for a

reproductive success study. Red-footed boobies did not nest in abundance in areas included in the study and many red-footed boobies nested later than they had in previous years. The red-footed booby data for the reproductive success and chick growth studies were further limited because the field camp departed the island before birds fledged. Red-tailed tropicbirds also nested late this year, resulting in similar limitations in the studies of this species. Populations and phenology data were collected on Laysan Island for a variety of seabird species.

Data from the seabird monitoring studies in 1985 are presently being analyzed. Preliminary results are available for reproductive success of black noddies and red-footed boobies on Tern Island, French Frigate Shoals. These data suggest that hatching success (% of eggs laid that hatch) and overall breeding success (% of eggs laid from which chicks fledge) have declined somewhat erratically since 1980. Fledging success (% of eggs hatching from which chicks fledge) remains high. Censuses indicate an increase in the breeding population over this same time period. Reduced breeding success rates may be due to the large percentage of younger, more inexperienced breeders we believe are now in the population. Continued banding efforts may enable us to confirm this.

Trip reports detailing biological observations are available in refuge files. These include:

| Date             | Location(s)  | FWS Personnel   |
|------------------|--|---|
| April 1-10       | Laysan Island  | Volunteer Biologist Pyle  |
| Mar. 2--Apr. 10  | Laysan Island  | Volunteer Biologist Conant  |
| Mar. 21--Apr. 14 | Laysan Island  | Wildlife Biologist Hu, Biological Aide Bean, Volunteer Biologist Pyle |
| Apr. 1--Jul. 21  | Laysan Island  | Biological Aide Bean  |
| May 15--Jun. 13  | Nihoa Island,<br>Laysan Island,<br>Lisianski Island,<br>Pearl & Hermes<br>Reef | Supervisory Wildlife Biologist Fefer,<br>Wildlife Biologist Hu        |
| Jun. 12--Jul. 26 | Pearl & Hermes<br>Reef   | Volunteer Biologist Conant  |

Trip Reports cont.

Oct. 2--Oct. 16           Laysan Island           Biological Aide  
Bean

Populations and reproductive chronology of seabirds were also studied at Pearl and Hermes Reef during a short visit to these islands by Wildlife Biologists Hu and Fefer during June.

## HWN-2-85 Golden Plover Study

This study was initiated in 1982 and is being conducted in cooperation with Dr. Oscar Johnson of Moorhead State University, Moorhead, Minnesota, and Dr. Phil Bruner from Brigham Young University, Hawaii. The study is focusing on the significance of feeding territories established by annual migrants at Tern Island. Only a small percentage of the birds that migrate to the island survive, and it is believed that their ability to establish a feeding territory is a critical factor. The birds are trapped and color banded. Other data such as weight and plumage characteristics are also recorded. Several years of data exist, and it is now possible to plot specific territories of individual birds from year to year. During 1985, eleven golden plovers were added to this study.

HWN-3-85 Hawaiian Monk Seal Study  
(Special Use Permit HWN-3-85)

The refuge staff at Tern Island have been counting Hawaiian monk seals hauling out on Tern Island beaches since 1979 when the island was acquired from the U.S. Coast Guard. The counts were made every four days until November 1985 when the interval was lengthened to 7 days. The data are summarized in the following table. They show a continuing increase in the number of seals using Tern Island since the FWS assumed total management responsibility. Mean monthly numbers have increased from 5.7 seals in July 1979 to 127.6 seals in March, 1985. The highest individual count was 181 on March 5.

Most of the research on Hawaiian monk seals in the Hawaiian Islands NWR is being conducted by personnel from the National Marine Fisheries Service. This agency has jurisdictional authority over most marine mammals. The research was conducted under Special Use Permit HWN-3-85 and is summarized below:

Average Monthly Numbers of Hawaiian Monk Seals  
Using Beaches on Tern Island, French Frigate Shoals

| MONTH       | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985  | MEAN |
|-------------|------|------|------|------|------|------|-------|------|
| January     |      | 10.8 | 29.6 | 33.9 | 60.2 | 49.8 | 96.9  | 46.9 |
| February    |      | 14.2 | 28.8 | 31.6 | 72.5 | 56.9 | 107.8 | 52.0 |
| March       |      | 24.5 | 25.9 | 39.3 | 59.4 | 77.3 | 127.6 | 59.0 |
| April       |      | 13.9 | 28.0 | 36.9 | 47.3 | 49.6 | 81.4  | 42.9 |
| May         |      | 14.9 | 22.9 | 28.4 | 41.0 | 34.1 | 56.1  | 32.9 |
| June        |      | 16.7 | 19.6 | 30.5 | 36.0 | 48.6 | 45.9  | 32.9 |
| July        | 5.7  | 17.7 | 20.7 | 43.0 | 41.4 | 50.9 | 83.6  | 37.6 |
| August      | 5.3  | 21.9 | 27.3 | 46.6 | 53.3 | 69.4 | 80.5  | 43.5 |
| September   | 4.3  | 19.5 | 28.3 | 44.3 | 46.4 | 56.9 | 62.7  | 37.5 |
| October     | 2.5  | 23.4 | 43.4 | 49.9 | 61.3 | 72.1 | 81.5  | 36.1 |
| November    | 9.0  | 22.9 | 43.5 | 56.1 | 68.7 | 94.5 | 113.3 | 58.3 |
| December    | 13.7 | 33.5 | 37.5 | 48.6 | 67.0 | 90.6 | 89.7  | 52.4 |
| Annual Mean |      | 19.5 | 29.6 | 40.8 | 54.5 | 62.6 | 85.6  |      |

French Frigate Shoals

Personnel from NMFS were present at French Frigate Shoals from April 4 to September 11, and again from December 2 to 19. Personnel conducting the research were (at various times): G. Balazs, J. Eliason, T. Gerrodette, J. Leialoha, R. Morrow, G. Peiterson, M. Webber, and R. Withrow. During this time, censuses were regularly conducted, identities of parturient females were determined, and pups were tagged.

- A. Pup Production/Tagging: A total of 96 pups were born in 1985, of which 87 survived to weaning and were tagged. Pups were born on all islands except Shark, Mullet, and Disappearing. Most of the births (94%) were on East, Whale-Skate, and Round Islands.
- B. Tag Resights: Of the 92 pups tagged in 1984, 73 (79%) were resighted as juveniles in 1985.
- C. Parturient Females: Seventy-six of the 96 parturient females were drawn and/or photographed. Forty-six of these females were known animals with permanent identification numbers. Close observation of female/pup pairs on East Island revealed that 54% (20 of 37) of the females parturient on East exchanged pups during the nursing period. The greatest number of exchanges occurred in mid-late April, when the number of nursing pairs was highest.
- D. Deaths/Injuries: Eleven seals died and two nursing pups disappeared in 1985. Six of the deaths were of newborn pups, which were probably stillborn. Summaries of the other five mortalities are still being compiled. Twenty-three seals were observed with injuries, 13 of which had probably been caused by attacks of other seals.
- E. NMFS collected two underdeveloped pups at French Frigate Shoals for rehabilitation. Data for these pups are as follows:

|                                       |                       |
|---------------------------------------|-----------------------|
| Tag Number                            | K23 (Yellow)          |
| Birth Location:                       | Probably Round Island |
| Birth Date:                           | Unknown               |
| Tagging Date:                         | May 30, 1985.         |
| Length at Tagging:                    | 127.0 cm              |
| Girth at Tagging:                     | 89.5 cm               |
| Age at Tagging:                       | Unknown               |
| Date Transported to<br>Honolulu (WA): | June 12, 1985         |
| Weight on Arrival:                    | 80 lb.                |

|                                       |               |
|---------------------------------------|---------------|
| Tag Number:                           | K37 (Yellow)  |
| Birth Location:                       | East Island   |
| Birth Date:                           | May 18, 1985  |
| Tagging Date:                         | June 29, 1985 |
| Length at Tagging:                    | 119.0 cm      |
| Girth at Tagging:                     | 85.5 cm       |
| Age at Tagging:                       | 42 days       |
| Date Transported to<br>Honolulu (WA): | July 3, 1985  |
| Weight on Arrival:                    | 90 lb.        |

Both pups are presently (as of December 31, 1985) being maintained at the NMFS Kewalo Research Facility. They are eating consistently and appear to be in good health. These pups will be moved to the headstart pen at Kure Atoll in March, 1986.

The three female seals collected as underdeveloped pups at French Frigate Shoals in 1984 (under Special Use Permit HWN-9-85) were transported on June 21, 1985, from Honolulu to the headstart pen at Kure Atoll. They were maintained in the pen and were fed live, locally caught reef fish until August 27, at which time they were released. All three were being regularly resighted on Green and Sand Islands up to the time NMFS personnel departed Kure on October 23, 1985.



National Marine Fisheries biologist Julie Leialoha and Refuge Manager Martin tagging a monk seal pup on Tern Island. CK (Volunteer)

Two male seals collected as underdeveloped pups in 1984 were being maintained at the Waikiki Aquarium as of December 31, 1985. (One of these, T57, died on January 3, 1986).

The only underdeveloped pup collected in 1984 (which was actually released at Kure in 1984) was a male, T02, which was released on July 24, 1984. On April 8, 1985, this animal was found dead on Shark Island, having been at liberty for 258 days. A necropsy did not definitively reveal the cause of this animal's death, although stomach parasites and attendant infected ulcers may have debilitated the seal.

#### Necker Island

Necker was visited by NMFS personnel (B. Becker) on a single day, August 24. A census was conducted, and a juvenile seal which had been tagged as a pup in 1984 at French Frigate Shoals was resighted.

#### Laysan Island

NMFS personnel were present on Laysan Island from March 2 to November 30. Personnel were: S. Austin, B. Becker, J. Henderson, T. Johanos, J. Leialoha, R. Morrow, and R. Watson. Research activities included tagging weaned pups and some adult males, conducting regular censuses, collecting data on adult male behavior, watching for mobbings by male seals, and bleach marking adult and subadult males. Personnel also cataloged, sampled, and burned derelict webbing and other debris which was hazardous to monk seals and seabirds.

A. Pup Production/Tagging: Thirty-two pups were born in 1985, 30 of which survived to weaning and were tagged. Nine adult males were tagged with metal Monel tags.

B. Tag Resights:

| Year Tagged | Number Tagged | No. Resighted in 1985 |
|-------------|---------------|-----------------------|
| 1983        | 20            | 20                    |
| 1984        | 29            | 26                    |

One pup of 1984 had lost one tag; all other animals retained both tags. A subadult tagged in 1982 at Lisianski was also seen regularly (as it also was in 1984 at Laysan).

- C. Census: Censuses were conducted every three days, and observations of male-male and male-female pair behaviors were made daily. These data are still being compiled and analyzed.
- D. Deaths/Injuries: Two pups died prior to weaning. Five other seals (one weaned pup, two subadult males, and two adult females) died from injuries attributable to attacks by other seals. Approximately 40 other seals were observed with fresh wounds of various size and severity. Many of these injuries appeared to be bites by the cookie cutter shark (Isistius sp.).
- E. Entanglement/Debris: No seal or turtle entanglements in webbing or other debris were observed. All debris was cataloged and sampled.
- F. Bleach Marks: Bleach marks were applied to 46 adult and subadult males which did not have marks remaining from 1984. All adult and subadult males were marked in 1985 following their molt.

#### Lisianski Island

Two people (D. Alcorn and R. Westlake) were present on Lisianski Island from June 17 to July 20. Results are as follows:

- A. Pup Production/Tagging: There were fifteen known births (6 males, 9 females) on Lisianski Island in 1985. Fourteen were tagged (one was still nursing when the crew departed), one fewer than 1984.

- B. Tag Resights:

| Year Tagged | No. Tagged | No. Resighted in 1985 | Comments   |
|-------------|------------|-----------------------|--|
| 1984        | 15         | 14                    | One male missing.  |
| 1983        | 24         | 18                    | Three missing from 1984.   |
| 1982        | 13         | 11                    | None missing from 1984; saw one in 1985 that didn't see in 1984. |

- C. Census: Fifteen formal censuses and 33 informal patrols were conducted. Approximately 1/3 of the total Lisianski seal population was identifiable (56 by tags, 16 by scars). Little interatoll movement to/from Lisianski was detected.

- D. Deaths/Illness and Injury: No deaths were detected. Ten injuries (of which one possibly led to death) were noted. Six were attributed to mobbing, 3 to sharks, and 1 unknown.
- E. Entanglements: None were observed, but seals were sighted resting on or partially wrapped in debris. Eighty-four entangling items were inventoried and burned, of which 26 were nets or net fragments.

Pearl and Hermes Reef

Four people (S. Conant, T. Johanos, R. Morrow, and R. Watson) were present June 18 to July 17. Research was conducted June 19 to July 7. Results are as follows:

- A. Pup Production/Tagging: Nineteen known births (9 males, 7 females, 3 sex unknown). One known mortality (a female perinatal pup). Fifteen (all) weaned pups tagged, 3 pups still nursing at end of season.
- B. Tag Resights:

| Year<br>Tagged | No. Resighted<br>in 1985 | Comments                                    |
|----------------|--------------------------|---|
| 1984           | 12                       | --  |
| 1983           | 8                        | --  |
| 1981 (Kure)    | 1                        | Present at P&H<br>in 1984, born at<br>Kure. |

- C. Census: Sixteen formal censuses were conducted at Southeast and Seal-Kittery Islands (June 20 to July 16) and nineteen formal censuses were conducted at North and Little North Islands (June 23 to July 13). Total numbers seem comparable to previous years, but the data have not been analyzed yet. On days when total atoll censuses occurred, the number hauled out was usually 50 to 60 seals. No interatoll movement was detected except for #609, a Kure 1981 pup (male) which was seen at Pearl and Hermes Reef in both 1984 and 1985.
- D. Deaths/Illness and Injury: One death (the female pup mentioned earlier) and one fresh injury (attributed to a cookie cutter shark bite) were detected.
- E. Entanglements: No seals were found entangled; but one live turtle was found entangled in a net on the reef. Net/rope items on the beach were inventoried and either burned or pulled up past the berm.

HWN-4-85 Kure Atoll Hawaiian Monk Seal Pup Headstart Project and French Frigate Shoals Pup Rehabilitation Project (Special Use Permit HWN-10-85)

The Hawaiian monk seal female pup "headstart" project at Kure Atoll was initiated in 1981. In 1985 three female pups were born at Kure and placed in the enclosure. They were released on September 22. Of ten female pups "headstarted" from 1981 through 1984, nine were sighted regularly in 1985.

Three small female pups collected at French Frigate Shoals in 1984 were fattened through the winter months in Honolulu, screened for disease and genetic problems, and taken to Kure in June of 1985. By August it was certain they were all catching live fish in the enclosure and they were released. These three are now being resighted on all the islands at the atoll. Two more small female pups were collected at French Frigate Shoals in 1985 and will be similarly processed and released at Kure.

HWN-5-85 Green Sea Turtle Study (Special Use Permit HWN-3-85)

NMFS staff conducted studies of green sea turtles at French Frigate Shoals, Laysan Island, Lisianski Island, and Pearl and Hermes Reef. These are reviewed below:

On East Island, French Frigate Shoals, NMFS biologists conducted surveys of the turtle nesting population from June 11 to 29. During 18 nights of observations, 131 turtles were sighted. An estimated annual nesting population of 252 individuals resulted from these surveys. This is the highest nesting population estimate recorded in the 13 years of study and is similar to the estimate for 1984, which was 248.

Of particular interest is the tag recovery of a nesting female at East Island that was tagged in 1983 while foraging at Johnston Atoll 450 miles to the south. This is the first record of migration outside the Hawaiian archipelago.

The following table summarizes green sea turtle tagging at French Frigate Shoals during 1985:

| Age/Sex      | No. Newly Tagged | No. Tag Recoveries | No. Tagging Encounters |
|--------------|------------------|--------------------|------------------------|
| adult female | 99               | 65                 | 164                    |
| adult male   | 6                | 3                  | 9                      |
| TOTAL        | 105              | 68                 | 173                    |

Again, only low levels of nesting were documented at Pearl and Hermes Reef, Lisianski, and Laysan Islands. Counts of nesting pits suggested that no more than 20 or 30 females in total were nesting at these locations.

On Lisianski Island, 29 turtles were identified. Eleven tagged turtles and twelve paint-marked turtles were recovered and six turtles were newly tagged. One turtle was observed laying and a few others digging pits. A total of 78 individual pits known to be from 1985 were identified and mapped. Growth rates of recaptured turtles reconfirmed the slow growth measured in previous years (<1 cm. per year).

On Pearl and Hermes Reef, 33 turtles that had been tagged or marked were identified. Turtles were captured with a scoop net while foraging in shallow algal pastures. One paint-marked and fifteen tagged turtles were recovered and 17 were newly tagged.

On Laysan Island, three turtles were tagged and four previously-tagged individuals were captured.

#### HWN-6-85 . Lobster Study

Dr. Craig McDonald of the University of Hawaii concluded his study of the life history, growth and production of two species of lobster in April when funding ran out. He had been studying lobsters in the HINWR since 1983 in an effort to develop recruitment and production models. Monthly collecting of lobster larvae continued through the first four months of the year with Tern Island staff tending larvae collectors anchored between Tern and Trig Islands, French Frigate Shoals. Dr. McDonald had contracted the staff to tend the collectors on their own time during weekends.

#### HWN-7-85 Laysan Finch Study - Pearl and Hermes Reef (Special Use Permit HWN-4-85)

Dr. Sheila Conant of the University of Hawaii continued studies on the comparative ecology of Laysan finches in the Hawaiian Islands NWR. She traveled to Laysan Island in March and to Pearl and Hermes Reef during the period June 18 to July 19.

In 1967, 110 Laysan finches were introduced from Laysan Island to Pearl and Hermes Reef. Though similar translocations were attempted elsewhere, only at Pearl and Hermes did Laysan finches survive. The present population, which is distributed over the four vegetated islets (Southeast, Grass, Seal Kittery, and North), has recently been estimated at 500 to 700 birds, and is probably at carrying capacity of the habitat.

Available vegetation surveys and maps of both Laysan and Pearl and Hermes, as well as firsthand observations made in 1983, revealed that though the islands share many plant species, relative abundances of the species may differ greatly. This is true of Tribulus cistoides, one of the plants whose seeds are eaten by Laysan finches. Early in 1984, Dr. Conant developed the hypothesis that the finches at Pearl and Hermes may have undergone behavioral or even morphological adaptations since 1967 in response to food availability, particularly of Tribulus mericarps. In 1981, Boag and Grant described such a phenomenon for Geospiza fortis on Daphne Island in the Galapagos.

During the summers of 1984 and 1985, Dr. Conant banded and/or measured 297 finches at Pearl and Hermes Reef. During March and April of 1985, she banded and/or measured 278 finches on Laysan Island. In addition she collected, or asked other biologists to collect, samples (minimum 50 mericarps) of Tribulus from Pearl and Hermes Reef, Lisianski, Laysan, and French Frigate Shoals in order to compare morphological variation of the mericarps among the islands.

A preliminary review of the measurements of the birds and the mericarps indicates that there are size differences between both the bird and Tribulus populations on Laysan and Pearl and Hermes Reef.

Future research will entail analysis of currently available data and collection of additional data on feeding behavior, food availability, plant community structure (including relative abundance of food plants), and reproductive biology of the finches and their food plants.

Dr. Conant also censused the populations on the four islets of Pearl and Hermes Reef. Finches were banded at Southeast Island (53), Grass Island (16), Seal Kittery Island (14), and North Island (131). Measurements were taken on all but 16 of these birds. While banding on the various islets, the following nests were located: Eleven nests were found on Southeast Island; 3 were found on Grass; 1 on Seal Kittery; and 17 on North. Because of the brevity of the field camp on Pearl and Hermes Reef, these nests were not followed for information on reproductive success.

HWN-8-85 Biological Investigations of Laysan's Hypersaline Lake and Related Aspects (Special Use Permits HWN-5-85 and HWN-6-85)

Drs. Wayne Gagne and Petra Lenz are cooperators on this study which is partially funded by a grant from the National Geographic Society. Dr. Gagne visited Laysan from March 2 to April 11 and Dr. Lenz and her assistant, Ted Musashi,

visited Laysan from June 16 to July 21 to collect data for this study. This study focuses on the ecology and bathymetry of the hypersaline lake (lagoon), especially the life cycle of the brine fly (Neoscatella notata) and brine shrimp (Artemia sp.) which breed in abundance there.

Dr. Gagne concentrated his studies on the brine fly and related aspects of the Laysan duck's feeding ecology. All stages of the fly are a major component of the duck's diet. Adults and ducklings are so adept at catching flies on the wing that the bird may be more aptly called a "fly-catching duck". It is theorized that this food source permitted the duck to narrowly avoid extinction when Laysan's vegetation was devastated by rabbits, causing alternate food sources of the duck, e.g. cutworms, to become extinct or virtually disappear. Food competition presently comes mainly from migratory shorebirds which feed on immature brine flies, and a minor component from predatory shoreline invertebrates and ruddy turnstones feeding on adult flies. Some aspects of the brine fly's life history are most remarkable in that the adults emerge from the pupae on the lake bottom, remaining enclosed in a bubble which they enlarge from smaller bubbles on their exposed legs. Adults remain there until their wings are fully expanded, at which point they pop to the surface and fly off. If this act is premature, they drift haplessly to certain doom toward the phalanx of shorebirds lining the shallow waters of the hypersaline lake.

In most temperate hypersaline lakes, both brine flies and shrimp virtually disappear during the winter (Lenz 1982). Although field data do not cover an entire year, it seems that at Laysan these invertebrates are present and probably abundant year-round. The annual temperature and salinity ranges for the lake are within the tolerance limits for Artemia. A more detailed sampling program is needed to establish the seasonal population dynamics of these two invertebrates.

Dr. Lenz observed ducks feeding and collected fecal samples. Not surprisingly, the duck was found to catch a large variety of prey. Among the most common prey items are brine flies, Artemia, Lepidopteran larvae, and cockroaches. More data are needed to determine if the duck's diet changes seasonally.

HWN-9-85 Fishery Resource Assessment Survey  
(Special Use Permit HWN-12-85)

The Division of Aquatic Resources, State of Hawaii, again conducted resource assessment surveys in the HINWR from the R/V KILA during the month of July. The survey area included Nihoa, Necker, French Frigate Shoals, and Maro Reef. A total of 425 white ulua (Caranx ignobilis) and 34 omilu (C.

melampygus) were tagged to study movement and assess population size. 644 fishes were sampled for ciguatera studies. Two fish transect stations were re-monitored to measure stability of species composition and population densities. Spiny and slipper lobsters were trapped to study trap retention rates.

HWN-10-85 Collection of Olivine Basalts (Special Use Permit HWN-7-85)

Dr. Harmon Craig, University of California, using the R/V MELVILLE, landed at La Perouse Pinnacle and Necker and Nihoa Islands in August to collect hand specimens of olivine basalt rock. The specimens will be deposited in the Scripps Institute of Oceanography rock collection and will be used to determine the types and characteristics of volcanic eruptions which created the islands.

#### E. ADMINISTRATION

##### 2. Youth Programs

1985 was the third year of the YCC program at Tern Island. Two high school students from Oahu, Gregg Natividad and Irving Figueroa, were selected, and worked six weeks at the Tern Island field station. A significant amount of their time was spent assisting with the construction of the new boat dock. Twenty-six other jobs were completed which included: painting, small construction projects, assisting with boat deliveries and cleaning fresh-water and salt water storage tanks. They also participated in biological studies, which included seabird reproductive success studies, Hawaiian monk seal and green sea turtle censuses, the monthly breeding bird count, and tabulating fish species observed around Tern Island. The program was very successful and we are looking forward to participating again in 1986.

##### 4. Volunteer Program

Volunteers play a very important role in the refuge, assisting in a variety of projects. Volunteers were active on Tern Island, Laysan Island, and Pearl and Hermes Reef. Several spent considerable time at Tern Island and proved very helpful, especially when the refuge was short-handed during a change in staff. Volunteer Robin Hanford assisted in the operation of the station and was instrumental in the rescue of the crew of the fishing vessel CAROLYN K (see section J.3). Jan Dierks and Bill Meunch assisted in the

biological and maintenance work on Tern Island and greatly assisted in the station's operation during the changeover in staff. Sheila Doyle, Lee Tibbetts, and Denise Mungioli put in many hard and long hours working on the seabird monitoring studies. Martin Wohl also assisted in seabird studies late in the season. Joan Suther conducted seabird monitoring studies, Hawaiian monk seal, and green sea turtle surveys and provided general assistance to the staff and visiting researchers. Joan also entered the biological data into the computer files at the Honolulu office. Cheryl Kval provided general assistance to the staff, typed reports, organized files and assisted with biological studies.



Volunteer Joan Suther and Greg Natividad (YCC Worker) banding a red-tailed tropicbird chick.  
RTV

A group of volunteers including Sheila Doyle, Susan Harada, Frank Magee, Patrick Ching, Cynthia Krakowski, and Denise Mathews assisted Biological Technician Bean in the construction of a sand drift fence on Laysan Island (see Section F.2). A trip report is available in the Refuge files detailing this expedition. Dr. Sheila Conant participated in the Volunteer program on Laysan Island in March and on Pearl and Hermes Reef in June/July. Trip reports are available summarizing the work conducted. On Laysan Island, Dr. Conant conducted Laysan duck counts and reported on the phenology and populations of nesting seabirds. Sheila conducted Laysan finch population surveys

on Pearl and Hermes Reef. Robert Pyle participated in a field expedition to Laysan Island in March/April. Pyle conducted pelagic surveys of seabirds en route between Honolulu and Laysan Island. He also conducted surveys of migratory shorebirds on the Laysan lagoon (hypersaline lake) during his visit (see Section G.5). Reports are available in refuge files which detail these observations.

## 6. Safety

The Regional Safety Officer visited Tern Island early in the year. His major findings and recommendations were:

1. The noise level during flights aboard the Beechcraft 18 to Tern Island averages 90-96 Db. Hearing protection was recommended for all passengers--particularly those making a round trip flight (7-8 hours in length) on the same day.
2. The boat hoist is badly corroded and constitutes a serious safety hazard. Renovation/replacement was recommended.
3. Dependable radio communication with Honolulu is a concern. The U.S. Coast Guard is not responding to Tern Island transmissions. Contact should be made with the Coast Guard Communications Station on Oahu to discuss the problem.

All of the Safety Officer's recommendations were carried out. Sponge ear inserts were purchased and are now distributed to passengers prior to each flight. A contract was let for the purchase of a new boat hoist (see below). During a discussion with the Commanding Officer of the Coast Guard communications station, it was discovered that Tern Island was listening on the wrong frequency. A weekly radio check between Tern Island and the Coast Guard was also initiated.

Safety is a major concern on the refuge because the islands are so remote. An emergency medivac to Honolulu requires at least ten hours if the accident or illness occurs at Tern Island and much longer if the sick or injured person is elsewhere in the refuge. For this reason, safety precautions are taken seriously. Radio schedules are maintained between Honolulu, Tern Island, and refuge field camps in order to ensure communication in the event of an accident. An emergency plan is maintained with the Coast Guard in the event of a communications breakdown.

Dr. Ken Nakasone of the Honolulu Medical Group continued to act as medical advisor for remote island personnel, stations, and field camps. He was called upon numerous times to assess medical problems via the radio. He also

visited Tern Island to discuss medical procedures with the new Refuge Managers and to inventory the island's stock of prescription drugs and medical supplies. Dr. Nakasone also provides advice on first aid supplies for remote island field camps and boat charters.

Standard safety procedures were taken during flights, heavy equipment use, and boat operations, and no major accidents occurred. Several minor injuries (back sprains, bumped head, cut toe) requiring medical attention did occur on Tern Island. In addition, arrangements were made with a Navy P3 Orion to air drop prescription drugs for treatment of a serious eye infection suffered by one of the volunteers at Tern Island.



A U.S. Navy P-3 conducting an emergency air drop of medication at Tern Island. Note the container just below the tail. RTV

The Tern Island rainwater collection system and water treatment procedures were examined to determine if problems exist with the freshwater system. Concerns include levels of chlorination, bacterial contamination of water storage facilities, and substrate of water catchment area. Water storage facilities and the water catchment area may require modification in the future.

Planning was initiated to remove and properly dispose of transformers containing PCB's (representing no immediate danger). The transformers were left on Tern Island by the

U.S. Coast Guard when their LORAN station was decommissioned in 1979.

Concerns developed about the safe use of the boat hoist on Tern Island after electrical problems occurred. An engineer's report, dated March 1984, and the Safety Officer's report of February 1985, also questioned the structural integrity of the unit due to the copious rust formations. As a result, a contract was let for the purchase of a new boat hoist. Installation should be complete by February, 1986. To reduce accident risks, several modifications were devised for the present boat hoist, including extension of the remote control cables.

On Tern Island, The ATV (Heald Hauler) caught fire, requiring the use of a fire extinguisher. The cause of the fire was determined to be a faulty alternator coil.

On Tern Island, a hazardous 65-foot leaning telephone pole was removed. Emergency runway lights and wiring were destroyed during the December storms. Plans are being considered for replacement.

#### 7. Technical Assistance

Refuge staff in Honolulu and on Tern Island continued to provide technical assistance to refuge cooperators and permittees concerning permit coordination, logistics, and requirements for research and other activities in the Northwestern Hawaiian Islands. A wide variety of technical assistance was provided to various government agencies, several institutions, and numerous fishing vessels.

Assistance was provided to Japan Public Broadcasting Co. (NHK) during their visit to the Hawaiian Islands NWR in May/June. Assistance was provided by the refuge staff to the National Weather Service and the University of Hawaii's Department of Oceanography in preparation for and during their visits to Tern Island to service their remote sensing meteorological station and tide gauge.

Refuge staff provided advice on mechanical repair work and logistical support to NMFS field camps at French Frigate Shoals and other remote islands. In addition, numerous radio checks and messages were relayed between Honolulu and field camps. Communications and logistical assistance is routinely provided to vessels fishing in the vicinity of French Frigate Shoals. Under the conditions discussed below under Section H.17, the Emergency Mooring Buoy 1-1/2 miles south of Tern Island is also made available to assist vessels. The following boats used the buoy during 1985: FERESA, BOUNTY, THREE JACKS, ALEUTIAN SPRAY, DATRO, ELLIE B, SHAMAN, MAGIC DRAGON, and HOLOKAI.

Masked booby chicks were collected for the seabird display at Sea Life Park, Waimanalo, Oahu, in accordance with their Federal and State Migratory Bird Permits.

Humeri (four flipper bones) were collected from a dead green sea turtle for a NMFS study to age turtles.

## F. HABITAT MANAGEMENT

### 2. Wetlands

Drs. Wayne Gagne and Petra Lenz continued their studies of the physical and biological characteristics of the Laysan hypersaline lake during field camps in 1985. The studies are described above under HWN-8-85 of Section D.5. The lake supports the Laysan duck and substantial populations of migratory shorebirds. See also the discussion in this section below on Laysan Island.

### 6. Other Habitats

#### Tern Island:

Heavy ocean swells caused severe damage to the north side of Tern Island on December 9 and 20. A substantial amount of coral fill between the north seawall and the runway was swept across the entire runway to the south edge. Many shrubs (Heliotropium curassavicum) were uprooted or crushed by coral. Consequently, all albatross nests (approximately 150) on the north side of the runway were destroyed, and one adult Laysan albatross was buried alive. Only a small amount of debris was carried south of the runway, but considerable flooding occurred in that area. Defoliation of H. curassavicum was caused by salt water saturating the soil. However, this species is salt tolerant, and after several weeks, new leaves appeared. Flooding on the south side killed about 200 albatross eggs.

In the past, coral debris and surplus material have been used as fill behind the seawall. However, new methods of stabilizing this area will have to be developed since any object smaller than a 55-gallon drum loaded with coral is removed within seconds by large waves. Most of this material is deposited on the runway, requiring a major clean-up effort. During the December storm, a large area adjacent to the seawall was eroded, allowing normal sized waves to pass through the holes in the rusted wall. An erosion transect was established to monitor changes.

A chicken wire fence was constructed around the tennis court to prevent seals and albatross from entering the area and defecating. The court is used to collect rainwater for human consumption.

#### Laysan Island:

During 1984, two lines of fence totalling approximately 640 feet were constructed on the central eastern portion of Laysan Island to arrest drifting sand which was filling the freshwater seeps along the shoreline of the Laysan lagoon. These freshwater seeps are critical to the survival of the Laysan duck. During the 1985 field season, it was observed that the fence constructed in 1984 had successfully arrested sand deposition on the central eastern shoreline of the lagoon. The fence was observed to be buried in the sand and was no longer functioning. As a result, refuge staff organized and coordinated an effort to procure, transport, and construct 2,700 feet of fence on Laysan Island before the winter of 85/86. Refuge Manager Wass and Supervisory Wildlife Biologist Fefer coordinated with Coast Guard personnel Lt. Cmdr. Richard Buckingham, Captain of the Buoy Tender SASSAFRAS, and Commander Brandes of the Office of Aids to Navigation, to enable the Coast Guard to provide logistical support for this project.

In October 1985, the SASSAFRAS transported six FWS personnel and equipment including 50 rolls of fencing, 200 fenceposts, and field camp provisions to and from Laysan Island. Refuge Biological Aide Bean, Volunteers Patrick Ching, Suzan Harada, Frank Magee, Sheila Doyle and Cynthia Krakowski, along with four volunteers from the crew of the SASSAFRAS, constructed two rows of fence 1,850 feet and 850 feet in length. These additional rows of fence may arrest the drifting sand for another season and allow vegetation to naturally reestablish along the shoreline of the lagoon. This operation could not have occurred without the transportation and assistance provided by the Captain and crew of the Coast Guard Buoy Tender SASSAFRAS.

#### 10. Pest Control

Pest control in the Hawaiian Islands NWR involves prevention of alien introductions, monitoring existing and potential new introductions, and planning and implementing control procedures for problem introductions on a case by case basis. During 1985, pest control primarily involved implementing procedures to prevent the introductions of exotic organisms. Also during visits to the refuge, the status of exotic organisms were monitored.

The islands of the Hawaiian Islands NWR are extremely sensitive to the introduction of alien species. The natural

history of these islands is full of examples of problems when alien species are intentionally or unintentionally released on the islands. The introduction of rabbits on Laysan Island caused the extinction of the Laysan rail and Laysan honeycreeper early in this century. The problem of rodents on Midway and Kure in the Northwestern Hawaiian Islands chain serve to warn us about the introduction of rat species on refuge islands. Introductions of alien plants have caused problems on Southeast Island, Pearl and Hermes Reef, and other plant introductions compete with native plants important on these islands. The introduction of house flies on Laysan Island is another example of a major insect infestation resulting from an introduction. The introduction of mosquitoes on the refuge islands could result in catastrophic consequences if malaria was transmitted to the native landbirds. The endemic finches are thought to be highly susceptible to malaria. On Midway Islands, where mosquitoes have been introduced, avian pox, which is carried by mosquitoes, has caused problems for the large Laysan albatross population which nests there. These are just a few of many specific examples of potential problems with exotic introductions. It is for these reasons that refuge staff take great precautions when transporting equipment and visiting the remote islands.

Material transported to these islands must be packed in cleaned plastic or metal buckets that are sprayed with insecticide, not wood or cardboard boxes that may harbor insects, eggs, and/or plant seeds. Material that may carry seeds, insects, or eggs is fumigated before transport. For example, the fencing material which was transported to Laysan Island was professionally fumigated prior to transport. Many articles are frozen as an extra precaution to kill insects. Certain types of foodstuffs are not permitted on the islands. The refuge stipulates transport procedures for all islands through the Special Use Permits issued to refuge cooperators.

Birdstrikes during aircraft arrivals and departures have always been a safety hazard at Tern Island. Sooty terns continue to nest at each end of the runway. In an effort to curtail their nesting, several abatement techniques were attempted. Strategically placed 55-gallon drums were unsuccessful. An alternative was large black plastic sheets laid on the ground. This proved very effective in discouraging tern nesting. Shorebirds used the small puddles of fresh water that formed on the plastic.

Large numbers of great frigatebirds began nesting at the east end of the island in 1985. One hundred eighty-six nests were found in 1985 compared to one in 1983 and none in 1984. There is increased concern about bird airstrike hazards because of the frigatebird's large size and behavior.

An effort to control the spread of puncture vine (Tribulus cistoides) on Tern Island was initiated. The YCC students uprooted all vines on the southwest quadrant of the island and burned them at the dump.



An endangered Hawaiian monk seal and pup on the beach at Whale-skate Island, French Frigate Shoals. RCW

## G. WILDLIFE

### 2. Endangered and/or Threatened Species

The islands within the Hawaiian Islands NWR harbor four endangered land birds (all endemic to single islands), the endangered Hawaiian monk seal, and the threatened green sea turtle. The endangered land birds are the Laysan duck, Laysan finch, Nihoa millerbird, and Nihoa finch. Research conducted on these species was described in a preceding research section (D.5.). In addition to research, specific management practices directed toward the protection of

endangered and threatened species on the refuge include strict control of all research and other activities. The following are among the measures taken: (1) Entry onto the refuge is prohibited to all but persons with Special Use Permits. Permits are generally given only to activities which are likely to directly benefit the resources or improve management practices, so many requests are turned down. (2) All Special Use Permits include provisions to avoid disturbing endangered species. (3) Movement of all personnel on Tern Island is restricted to areas not frequented by seals and turtles. (4) Fishermen are given information indicating the boundaries of the refuge and regulations pertaining to entry.

Activities conducted on the refuge that may impact endangered or threatened species are also submitted to Section 7 (Endangered Species Act) consultation. Descriptions of actions that may affect Hawaiian monk seals and turtles are submitted to the National Marine Fisheries Service for consultation.

The Hawaiian Islands NWR has only one resident waterfowl species, the Laysan duck. It is an endemic and endangered species, inhabiting a hypersaline lake on Laysan Island. During 1985, Laysan duck populations were surveyed weekly from March 8 to early April and twice weekly from April 8 to July 21. Most counts were conducted at dusk, although dawn counts, night counts, and day counts were made for comparison. During the first month of the survey, no ducklings were observed. In April, the first presence of a few broods of ducklings was noted. The major period of nesting occurred in June/July; 71 ducklings were recorded on a lagoon on June 25. Thirty-eight Laysan duck lagoon surveys conducted from early March through mid-July resulted in a minimum count of 32 ducks (adults) during a count in early March and a maximum count of 187 (105 adults, 11 juveniles, and 71 ducklings) on June 25. Population survey results are used to indicate trends in the duck population from year to year. These counts do not represent actual populations. The actual population of ducks is expected to be at least twice the high counts of ducks which are seen in the lagoon. During the past few years, Laysan duck populations were thought to be low based on survey results. During 1985, duck populations of about 400 were still low but the presence of a relatively large number of ducklings and juveniles is encouraging.

On Laysan Island, transect surveys were conducted to census Laysan finches on April 7. Estimates from this count range from 6,527 to 9,500 (95% confidence interval). While this estimate is low compared to certain recent years, it is expected that the timing of the count may account for some of this discrepancy. This count was conducted prior to the breeding season, thus young of the year were absent and birds may be more secretive at this time.

Laysan finch transect surveys were also conducted at Pearl and Hermes Reef by Volunteer Dr. Sheila Conant during mid-June through mid-July. The following presents the results of the transect surveys conducted to determine Laysan finch populations on the islets of Pearl and Hermes Reef: Southeast I, 587 birds; Grass Island, 46 birds; Seal-Kittery Islands, 81 birds; North Island, 191 birds; a total finch population of 905 birds was estimated for the entire atoll.

This estimate is similar to the population estimated in 1984 using similar methods.



A red-footed booby roosting on a frond of the Pritchardia palm, a candidate endangered plant species at Nihoa Island. Refuge files photo.

Two endemic endangered passerine birds inhabit Nihoa Island--the Nihoa millerbird and the Nihoa finch. Populations of these species were surveyed May 17 to 18 by

biologists Hu and Fefer. Transect surveys were conducted for this purpose. The population estimate for Nihoa millerbirds was 69 to 401 millerbirds (95% confidence interval). This estimate is lower than the previous year. This may be due to the varied timing of the survey and/or the weather conditions when the survey was conducted. The first day of the 1985 survey was windy and rainy which perhaps made the birds more secretive and also made the birds more difficult to hear. Subsequent counts will be important in determining the status of Nihoa millerbirds. Estimates of Nihoa finches ranged from 2,304 to 4,084 individuals (95% confidence interval). This is similar to last year's survey estimates.



The endangered Nihoa finch, whose distribution is confined to 168-acre Nihoa Island. SIF

### 3. Waterfowl

The general lack of suitable habitat for waterfowl and the distance from major waterfowl migratory routes accounts for the rarity of this group within the refuge. The only resident waterfowl is the endemic and endangered Laysan duck which inhabits the hypersaline lake on Laysan Island. Studies of this species are described in the endangered species section above.

The following waterfowl were observed on Tern Island, French Frigate Shoals: One Eurasian wigeon (see photo below) was

observed on October 2, in a puddle on the runway. Three pintails (one male and two females) were recorded on October 4. The male and one of the females subsequently died. The remaining female was last seen on October 31. One unidentified duck was swimming with the pintails.



The Hawaiian Island refuges do get vagrant bird species from both sides of the Pacific which can lead to exciting and, at times, difficult birding. This duck rests in a rain water puddle on Tern Island. We believe it is a Eurasian wigeon or a hybrid of this species. Any thoughts from our duck experts out there?  
LDM

An estimate of the current numbers of breeding pairs and their distribution for the entire Northwestern Hawaiian Islands is presented in Table 1 (see following page). These numbers are from population surveys conducted in recent years. Due to the magnitude of the seabird population on these islands, the diverse phenology of the species, and the remoteness of the island colonies, it is not possible to survey all of the population on each island in every year. Thus, during visits to the islands, populations of indicator species are surveyed, and every five years detailed population surveys are scheduled to determine population trends.

On Laysan Island, observations of waterfowl were made throughout the duration of the field camp (March 2 to July 21). The only waterfowl observed other than Laysan ducks were nine pintails (4 males and 5 females) on March 9 to 15.

#### 5. Shorebirds, Gulls, Terns and Allied Species

The Hawaiian Islands NWR provides habitat for some of the largest and most important seabird colonies in the world. The islands harbor approximately 5.4 million breeding pairs of 18 species. The composition and number of breeding birds varies throughout the year. Because of the significance of the Hawaiian seabird population, indicator species of seabirds are emphasized in the monitoring program conducted on the islands. Baseline data on population size, phenology, egg size, reproductive success, chick growth rate, and food habits are collected from black noddies, red-footed boobies, and red-tailed tropicbirds on Tern Island and Laysan Island. These measurements are compared to those for prior years to detect changes due to natural or man-caused factors. Early detection of potential changes can avert significant population declines. Additional information on the seabird monitoring program is presented in section D.5., HWN-1-85.

During an expedition to Laysan Island in March/April, Volunteer Biologist Robert Pyle observed pelagic birds enroute. Virtually all birds recorded during the survey were species nesting in the NWHI. As expected, birds were much more numerous near nesting islands than in the long segments between islands. The only non-breeding species recorded were a few jaegers--probably Pomarine--and several shearwaters--one was probably a white-necked petrel and the rest probably sooty shearwaters. A detailed report on these observations is available in refuge files.

A herring and a western gull were observed during March by Sheila Conant on Laysan Island.

During the expedition to Laysan Island April 1 to 10, Volunteer R. Pyle conducted island-wide counts of migratory birds 3 times at 3-day intervals. Between 3,600 and 4,200 migratory shorebirds were observed during each of these counts. Lesser golden plovers comprised 50% of the migratory shorebirds on Laysan Island at this time. Ruddy turnstones comprised 45% and wandering tattlers comprised just under 5% of the migratory shorebirds on the island. Up to 95 bristle-thighed curlews were observed during one count. Other shorebirds observed in small numbers included bar-tailed godwits, sanderlings, dunlins, and dowitchers. Results of these counts are detailed in a report in the refuge files.

From April 19 to July 15 Biological Aide Bean conducted weekly island-wide migratory bird counts. The four common shorebirds observed were lesser golden plovers, ruddy turnstones, wandering tattlers, and bristle-thighed curlews. By mid to late April, most migratory shorebirds had departed Laysan. No more than 1,600 were present in late April. During May and early June, populations of these species were less than 100. By July, populations had again increased with an influx of early fall migrants. No unusual shorebirds were noted during this period. During a visit to Laysan Island in October 1985, a total of 5,500 migratory shorebirds were observed.

On Pearl and Hermes Reef, Dr. S. Conant observed a semipalmated or ringed plover (Charadrius semipalmatus or C. hiaticula) on North Island during July.

Three least terns (Sterna antillarum) were observed by Dr. Conant at North Island and Pearl and Hermes Reef.

A cattle egret was observed on Nihoa Island during May 16 to 20.

A Thayer's gull in first winter plumage was present on Tern Island from December 26 to January 8, and was found dead on January 23. It was identified by Edward Bean, Joan Suther, and Rick Vetter. Ruffs were sighted on two occasions. The first was seen January 22; the second, which later died, was sighted on East Island in late April. A western sandpiper was feeding with a group of turnstones on Tern Island on April 12-16. A dead least tern was collected in April. On May 25, a pectoral sandpiper was observed on the runway and feeding in grassy areas. The Wilson's phalarope sighting was well-documented over the course of its visit to Tern Island, August 10-13. One dowitcher was observed on Tern Island on November 5. Other non-breeding birds regularly observed at French Frigate Shoals were ruddy turnstones, Pacific golden plovers, cattle egrets, wandering tattlers, bristle-thighed curlews, and sanderlings.

Breeding birds (i.e. number of nests) are censused at monthly intervals at Tern Island and semi-annually for all islands at French Frigate Shoals. The results of these censuses are summarized in the tables below. It should be noted that record numbers of great frigatebirds nested on Tern Island this year. There was also a corresponding increase in the number of great frigatebirds roosting on Tern Island.

TOTAL NUMBER OF NESTS ESTIMATED FOR TERN ISLAND  
1983-1985

| Species                | 1983          | 1984          | 1985          |
|------------------------|---------------|---------------|---------------|
| Black-footed albatross | 193           | 221           | 292           |
| Laysan albatross       | 852           | 854           | 720           |
| Red-tailed tropicbird  | 201           | 308           | 527           |
| Red-footed booby       | 404           | 629           | 898           |
| Great frigatebird      | 1             | 0             | 186           |
| Gray-backed tern       | 56            | 48            | 121           |
| Sooty tern             | 12,500        | 13,000        | --            |
| Brown noddy            | 921           | 927           | 890           |
| Black noddy            | 726           | 615           | 1,201         |
| White tern             | 34            | 34            | 34            |
| <b>TOTAL</b>           | <b>15,888</b> | <b>16,636</b> | <b>4,869*</b> |

\*Does not include sooty tern nests

FRENCH FRIGATE SHOALS ATOLL-WIDE NEST COUNTS  
1984-1985

| Species                | 1984          |              | 1985          |                |
|------------------------|---------------|--------------|---------------|----------------|
|                        | 3/84          | 6/84         | 4/85          | 8/85           |
| Black-footed albatross | 2,490*        | 2,769        | 2,760         | 0              |
| Laysan albatross       | 1,109*        | 901          | 1,380         | 0              |
| Red-tailed tropicbird  | 163           | 327          | 352           | 365            |
| Masked booby           | 380           | 337          | 127           | 226            |
| Red-footed booby       | 540           | 611          | 618           | 510            |
| Great frigatebird      | 470           | 308          | 368           | 375            |
| Gray-backed tern       | 72            | 50           | 33            | 13             |
| Sooty tern             | 9,879         | 0            | 8,300         | --             |
| Brown noddy            | 857           | 1,407        | 1,150         | 200            |
| Black noddy            | 461           | 197          | 618           | 95             |
| White tern             | 18            | 20           | 27            | 8              |
| <b>TOTAL</b>           | <b>16,439</b> | <b>6,749</b> | <b>15,733</b> | <b>1,792**</b> |

Includes: Tern, Trig, Whale-skate, East, Gin, and Little Gin Islands.

Includes: Tern, Trig, Whale-skate, East, and Little Gin Islands.

Includes: Tern, Trig, Whale-skate, and East Islands.

\*Whale-skate not censused for albatross.

\*\*Does not include sooty tern nests.

TABLE 1. ESTIMATE OF BREEDING PAIRS OF SEABIRDS, NORTHWESTERN HAWAIIAN ISLANDS

|                         | Location          |                  |                       |                   |                    |
|-------------------------|-------------------|------------------|-----------------------|-------------------|--------------------|
|                         | Nihoa             | Necker Island    | French Frigate Shoals | Gardner Pinnacles | Laysan Island      |
| Black-footed albatross  | 40 to 60          | 200 to 250       | 4,000 to 4,500        | 0                 | 14,000 to 21,000   |
| Laysan albatross        | 1 to 5            | 450 to 550       | 900 to 1,000          | 10 to 15          | 105,000 to 132,000 |
| Bonin petrel            | 0                 | 0                | 30 to 50              | 0                 | 50,000 to 75,000   |
| Bulwer's petrel         | 75,000 to 100,000 | 250 to 500       | 200 to 500            | 10 to 15          | 1,000 to 2,000     |
| Wedge-tailed shearwater | 30,000 to 40,000  | 1,500 to 2,500   | 1,500 to 1,750        | 25 to 50          | 125,000 to 175,000 |
| Christmas shearwater    | 200 to 250        | 0                | 15 to 20              | 0                 | 1,500 to 2,000     |
| Sooty storm-petrel      | 2,000 to 3,000    | +                | +                     | 0                 | 500 to 2,500       |
| Red-tailed tropicbird   | 250 to 300        | 100 to 150       | 550 to 600            | 20 to 25          | 1,500 to 2,500     |
| Masked booby            | 250 to 300        | 250 to 300       | 500 to 600            | 125 to 150        | 400 to 425         |
| Brown booby             | 150 to 200        | 20 to 25         | 40 to 60              | 5 to 10           | 34                 |
| Red-footed booby        | 1,500 to 2,000    | 650 to 750       | 550 to 600            | 0                 | 250 to 300         |
| Great frigatebird       | 3,500 to 4,500    | 700 to 900       | 350 to 375            | 0                 | 2,000 to 2,500     |
| Sooty tern              | 10,000 to 25,000  | 12,500 to 25,000 | 60,000 to 78,000      | 250 to 500        | 375,000 to 500,000 |
| Gray-backed tern        | 9,000 to 12,000   | 3,500 to 4,500   | 750 to 1,000          | 1,500 to 2,500    | 5,000 to 10,000    |
| Blue-gray noddy         | 2,000 to 2,500    | 1,000 to 1,500   | +                     | +                 | 0                  |
| Brown noddy             | 25,000 to 35,000  | 10,000 to 15,000 | 5,000 to 7,500        | 1,000 to 1,500    | 10,000 to 15,000   |
| Black noddy             | 1,000 to 5,000    | 300 to 500       | 750 to 850            | 200 to 300        | 1,500 to 2,500     |
| White tern              | 1,000 to 5,000    | 100 to 300       | 500 to 750            | 150 to 250        | 600 to 1,000       |
| <b>TOTAL</b>            | <b>235,115</b>    | <b>52,725</b>    | <b>98,155</b>         | <b>5,315</b>      | <b>943,760</b>     |

NOTE: + indicates breeding occurs but there was not significant data to make a quantitative statement;  
 ? indicates breeding is suspected but no nests were found.

TABLE 1. ESTIMATE OF BREEDING PAIRS OF SEABIRDS, NORTHWESTERN HAWAIIAN ISLANDS  
(continued)

|                         | Location           |                       |                    |                 | Total            |
|-------------------------|--------------------|-----------------------|--------------------|-----------------|------------------|
|                         | Lisianski Island   | Pearl and Hermes Reef | Midway Islands     | Kure Atoll      |                  |
| Black-footed albatross  | 2,800 to 3,800     | 8,000 to 11,000       | 6,500 to 7,500     | 700 to 1,300    | 49,410           |
| Laysan albatross        | 23,000 to 30,000   | 9,000 to 12,000       | 150,000 to 200,000 | 3,000 to 4,000  | 379,570          |
| Bonin petrel            | 150,000 to 250,000 | 400 to 600            | 2,500 to 5,000     | 400 to 600      | 331,250          |
| Bulwer's petrel         | 50 to 100          | 10                    | 0                  | 0               | 103,125          |
| Wedge-tailed shearwater | 19,000 to 30,000   | 5,000 to 10,000       | 500 to 1,000       | 900 to 1,100    | 261,400          |
| Christmas shearwater    | 400 to 600         | 10                    | 25 to 50           | 20 to 30        | 2,960            |
| Sooty storm-petrel      | ?                  | 1,000 to 2,000        | 0                  | ?               | 7,500            |
| Red-tailed tropicbird   | 900 to 1,300       | 40 to 60              | 4,000 to 5,000     | 1,000 to 1,300  | 11,235           |
| Masked booby            | 300 to 350         | 140 to 160            | 5 to 10            | 65 to 75        | 2,370            |
| Brown booby             | 15 to 25           | 50 to 60              | 0                  | 50 to 60        | 474              |
| Red-footed booby        | 350 to 450         | 40 to 60              | 450 to 500         | 400 to 450      | 5,110            |
| Great frigatebird       | 750 to 850         | 300 to 400            | 60 to 75           | 200 to 250      | 9,850            |
| Sooty tern              | 400,000 to 600,000 | 35,000 to 45,000      | 30,000 to 45,000   | 8,000 to 12,000 | 1,330,500        |
| Gray-backed tern        | 15,000 to 20,000   | 650 to 750            | 100 to 200         | 30 to 50        | 51,000           |
| Blue-gray noddy         | 0                  | 0                     | 0                  | 0               | 4,000            |
| Brown noddy             | 7,500 to 15,000    | 1,700 to 2,000        | 500 to 1,000       | 700 to 800      | 92,800           |
| Black noddy             | 500 to 1,000       | 75 to 125             | 2,000 to 6,000     | 0               | 16,275           |
| White tern              | 50 to 100          | 10 to 20              | 5,000 to 7,500     | 5 to 10         | 14,930           |
| <b>TOTAL</b>            | <b>953,575</b>     | <b>84,255</b>         | <b>278,835</b>     | <b>22,025</b>   | <b>3,673,759</b> |

An estimate of the current numbers of breeding pairs and their distribution for the entire Northwestern Hawaiian Islands is presented in Table I (see following page). These numbers are from population surveys conducted in recent years. Due to the magnitude of the seabird population on these islands, the diverse phenology of the species, and the remoteness of the island colonies, it is not possible to survey all of the populations on each island in every year. Thus, during visits to the islands, populations of indicator species are surveyed, and every five years detailed population surveys are scheduled to determine population trends.



Two of the approximately 1,500 Laysan albatross that nested on Tern Island this year. LDM

#### 6. Raptors

Raptors were observed only at Tern Island this year and short-eared owls were the only species seen. One individual was seen on October 4 and again on November 5 and 6.

#### 7. Other Migratory Birds

Mockingbirds are becoming frequent visitors to Tern Island. A maximum of three individuals were on the island at one time, and the species occurred there from August to December.

An emaciated pigeon with a racing band on its leg was found on Tern Island. The owner was located with the help of Bob Justman. The bird came from Oahu, and at last report was fat and happy after being returned to Honolulu via Justman's aircraft.

#### 9. Marine Mammals

Several pods of bottlenose porpoises were observed at French Frigate Shoals. Some were sighted in the dredged channel off of the west end and north side of Tern Island.

Pods of spinner porpoises were observed at Pearl and Hermes Reef.

Monk seal observations and research are described above in Section D.5.

#### 14. Scientific Collections

Because of the many endemic and unique wildlife species found in the Hawaiian Islands NWR, specimens are valuable to museums and educational institutions. The refuge attempts to provide specimens to museums which make requests and have appropriate permits. During 1985, specimens were provided to the B.P. Bishop Museum, the Museum of the California Academy of Science, the North Carolina Museum of Natural History, Brigham Young University - Hawaii Natural History Museum, Sea Life Park, and the Seattle Aquarium.

Bird specimens salvaged from French Frigate Shoals were provided to the California Academy of Science and the North Carolina Museum of Natural History. These include skins, skeletons, and frozen carcasses as follows:

Specimens provided to the California Academy of Science:

##### Frozen (10):

1 black-footed albatross  
5 sooty terns  
3 noddies (black and/or brown)  
1 white tern

##### Skins (2):

1 ruddy turnstone  
1 ruff

Specimens Provided to the North Carolina Museum of Natural History:

Skins (17):

1 great frigatebird (adult)  
 1 red-footed booby (chick)  
 4 Laysan albatross (chicks)  
 1 brown noddy (adult)  
 1 brown noddy (fledgling)  
 5 sooty terns (fledglings)  
 1 sooty tern (chick)  
 1 sooty tern (adult)  
 1 black noddy (chick)  
 1 red-tailed tropicbird (adult)

Skeletons:

3 black-footed albatross (chicks)  
 2 Laysan albatross (chicks)  
 1 wedge-tailed shearwater  
 1 great frigatebird (chick)  
 1 brown noddy (adult)  
 1 sooty tern (adult)  
 1 red-tailed tropicbird (chick)

Frozen (3):

1 masked booby (chick)  
 1 sooty tern (chick)  
 1 wedge-tailed shearwater (chick)

One sooty storm petrel and 15 Laysan finches were salvaged on Laysan Island during March/April by Dr. S. Conant. These specimens were provided to the B.P. Bishop Museum.

One Laysan finch was salvaged at Pearl and Hermes Reef by Dr. Conant in June/July. This bird was provided to the Brigham Young University - Hawaii Natural History Museum.

Refuge staff also salvaged specimens from the Hawaiian Islands for diagnosis as to cause of death as well as for museum specimens. Specimens salvaged by refuge staff include:

2 Laysan ducks (ducklings)  
 5 sooty terns  
 1 least tern  
 5 great frigatebirds  
 22 Laysan albatross  
 2 white terns (fledglings)

Three hatchling green sea turtles were collected at Tern Island for the Pacific Reef exhibit at the Seattle Aquarium under Special Use Permit HWN-15-85 and Federal Fish and Wildlife Permit PRT-700085. The turtles were temporarily maintained at the Waikiki Aquarium, Honolulu, prior to shipment.

The National Marine Fisheries Service has been conducting research on "headstarting" underdeveloped pups from French Frigate Shoals by feeding these pups and transporting them and releasing them at Kure Atoll. This collecting and re-release program is described in the Research and Investigations section of this report (D.5).

Dr. Harmon Craig collected the following rock samples as discussed above under Section D.5:

La Perouse Pinnacles: Several bags of olivine basalt and basalt specimens.

Necker Island: Six good specimens of olivine basalt.

Nihoa Island: Thirty good samples of olivine basalt and basalt flows and some additional dike samples.

All samples will become part of the Scripps Institute of Oceanography collection.

Dr. Robert Pyle collected 13 skinks (Cryptoblepharus boutonii) and 11 geckos (Lepidodactylus lugabris) from Laysan Island and Tern Island in April under Special Use Permit HWN-8-85. These specimens have been deposited in the Bernice P. Bishop Museum in Honolulu.

#### 15. Animal Control

Refuge staff monitor the potential introduction of exotic animals such as the various species of rats and feral cats during visits to the islands. No exotic mammals were noted within the refuge this year.

#### 16. Marking and Banding

A variety of animals are marked and/or banded annually on the refuge islands. Hawaiian monk seals are bleach marked and tagged as part of the monk seal research project conducted primarily by NMFS. Green sea turtles are also tagged as part of the NMFS research program. Data on green sea turtles are presented in the discussion of this project in the Research and Investigations section (D.5). Monk seal data are summarized in the table below:

WEANED MONK SEAL PUPS TAGGED IN 1984 AND 1985  
AND RESIGHTED IN 1985

| Island     | No. Tagged<br>in 1984             | No. Tagged<br>in 1985             | 1984 Pups<br>Resighted in 1985      |
|------------|-----------------------------------|-----------------------------------|-------------------------------------|
| Kure       | 6                                 | 5                                 | 83%                                 |
| Pearl & H. | 13                                | 15                                | 92%                                 |
| Lisianski  | 15                                | 14                                | 93%                                 |
| Laysan     | 29                                | 29                                | 90%                                 |
| FFS        | 92                                | 77                                | 80%                                 |
| TOTAL      | 155<br>(85 males)<br>(70 females) | 140<br>(75 males)<br>(65 females) | 85%<br>(males=85%)<br>(females=84%) |

Birds are banded as part of the refuge effort to monitor seabirds and migratory shorebirds which use refuge islands. Banding efforts focus on species which are studied as part of the seabird monitoring effort. Productivity of various age classes, age at first breeding, and other factors relating to interpretation of the reproductive parameters are measured as part of the monitoring effort.

The following table summarizes banding activity on the refuge in 1985:

| Species                | Number Banded |
|------------------------|---------------|
| Black-footed albatross | 124           |
| Laysan albatross       | 1,163         |
| Red-tailed albatross   | 135           |
| Masked booby           | 3             |
| Red-footed booby       | 509           |
| Sooty tern             | 234           |
| Black noddy            | 757           |
| White tern             | 21            |
| Blue-gray noddy        | 1             |
| Ruddy turnstone        | 2             |
| Golden plover          | 2             |
| Bristle-thighed curlew | 1             |
| Great frigatebird      | 3             |

## H. PUBLIC USE

### 1. General

Public use of the Hawaiian Islands NWR is highly restricted because of the presence of endangered species and the high potential for introduction of exotic organisms to the fragile environment. In order to maintain public support for our programs, we attempt to keep the public informed by encouraging and assisting artists, journalists, and photographers in their effort to obtain information and photographs. This is done either at the Honolulu headquarters or by arranging for people to visit the refuge (usually Tern Island).

### 6. Interpretive Exhibits/Demonstrations

Complex Manager Leinecke presented a slide show and participated in a panel discussion on conservation issues in the Northwest Hawaiian Islands at a meeting of the Conservation Council of Hawaii. Leinecke and Refuge Manager Wass also gave a slide show and description of the Hawaiian Islands NWR to a contingent of the Honolulu City Council prior to their overflight of the Refuge during a visit to Midway and Kure.

Supervisory Wildlife Biologist Fefer presented a slide program for the Hawaii Audubon Society on the Hawaiian Islands NWR.

Refuge Manager Wass conducted a slide show on the birds of the Hawaiian Islands NWR at a Hawaii Audubon Society meeting. Refuge Manager Vetter presented slide programs on the natural history and management of the Hawaiian Islands NWR to the Hawaii Yacht Club and at three meetings on the mainland. Volunteer Biologist Suther also gave talks and slide shows to mainland clubs and schools.

Refuge staff assisted Sea Life Park in obtaining masked boobies for their Leeward Islands exhibit in accordance with their migratory bird permits. Refuge staff routinely provide information, leaflets, and brochures to various interested groups.

### 7. Other Interpretive Programs

Refuge staff worked with the Japan Public Broadcasting Corp. (NHK-TV) throughout the first part of the year in order to coordinate a joint expedition funded by NHK to the Hawaiian Islands NWR. NHK was interested in videotaping an expedition to the refuge islands as part of the celebration of the 100th anniversary of the Japanese immigration to Hawaii. Biologists Fefer and Hu accompanied four NHK

personnel to Nihoa Island, French Frigate Shoals, Laysan Island, Lisianski Island, and Pearl and Hermes Reef from May 15 to June 13. A one hour show on this expedition was presented throughout Japan in September. The show, entitled "The Unknown Hawaiian Islands", is narrated in Japanese, but an English version will be produced. NHK provided FWS with copies of the final show and also copies of additional footage. A World Wildlife Fund calendar was made using 35 mm. slide photographs taken during this expedition by one of the NHK participants. A travelling exposition of the photographs used in this calendar is scheduled for 1986 throughout major cities of the world. Footage taken during this expedition has also been used for various educational broadcasts in Japan.



Yuichi Kono, Nippon Hoso Kyokai (Japan Public Broadcasting Corporation) filming a wildlife documentary at Nihoa Island for Japanese Educational Television. SIF

#### 17. Law Enforcement

Law enforcement in the Hawaiian Islands NWR consists primarily of monitoring Special Use Permits, Migratory Bird Permits, and Endangered Species Permits issued to cooperators conducting studies on the refuge. In addition, refuge staff coordinate with the Coast Guard concerning potential illegal entry inside refuge boundaries.

On the southwest side of French Frigate Shoals, just inside the refuge boundary, an emergency mooring buoy is permitted by the Fish and Wildlife Service. The buoy provides a safe mooring for vessels during breakdowns or foul weather. Vessels are required to notify the Tern Island Refuge Manager upon using the buoy, as well as comply with other regulations listed in the U.S. Coast Guard's "Legal Notice to Mariners".

All fishing boats observed from Tern Island are contacted by radio. They are informed of refuge boundaries and rules governing the use of the buoy before their approach in order to reduce conflicts. This method has proven effective in establishing good working relationships with the captains.

## I. EQUIPMENT AND FACILITIES

### 1. New Construction

All 1985 construction, rehabilitation, and maintenance projects occurred at Tern Island. The major construction projects accomplished during the year include:

a. Boat Dock: The Tern Island Refuge Managers designed and constructed a new boat dock, which replaced the existing dock built in 1983. The new dock is 50% larger and can accommodate weight loads equal to the capacity of the boat hoist (2 tons). The new dock is constructed of old pieces of galvanized steel and aluminum (ladders and antenna towers). This represents a significant improvement over the wood frame construction of the previous years.

b. Diesel Fuel Pipeline: A permanent fuel pipeline was constructed in an effort to streamline refueling operations on the island. The new underground line runs from the 27,000 gallon fuel storage tanks to the NW and SW corners of the island. Fuel deliveries can now be conducted concurrently with supply deliveries by aircraft. In the past, the fuel pipeline was laid across the airstrip for each delivery. This project will also save a considerable amount of work associated with the assembly of the old line, and will reduce the hazard of recurring skin exposure to the fuel.



Tern Island Refuge Managers Martin and Vetter laying a fuel pipeline between the dock and the storage tanks at Tern Island. JE (NMFS)

c. Water Pipeline: A freshwater pipeline was extended to the boat hoist and dock area from the barracks. This has eliminated the need to move equipment and boats from the dock area for washdown.

d. Moorings: Two 1,000-pound moorings were constructed and anchored off of the NW and SW corners of the island. The moorings will be used during fuel deliveries and general work projects.

e. Boat Ramp: An emergency boat ramp was constructed of aluminum grate on the south barracks beach. The ramp provides access to the water during boat hoist breakdowns.

f. Tide Gauge: A new tide gauge and staff rod were constructed by the University of Hawaii's Department of Oceanography. The old gauge was damaged by a winter storm.

g. Kitchen Modifications: Several construction projects in the community kitchen were completed. The result has been a boon to the staff morale!

## 2. Rehabilitation

Rehabilitation of existing equipment and structures is a source of constant activity at Tern Island. Due to the low elevation (6-1/2 feet above sea level) and the small size of the island (37 acres), it is constantly sprayed with a corrosive salt mist. The major projects that occurred during the year are listed below:

a. Seawall: A major attempt was made to fill the large holes adjacent to the seawall and to fortify rusted out portions of the seawall itself. All heavy equipment and structures that were no longer useable (including the old Dodge truck and rusted steel I-beams), were positioned along the wall. In addition, numerous 55-gallon drums were filled with coral and positioned along the eroded portions. On two separate occasions during the month of December, large waves swept over the seawall and across most of the island. The waves removed all the fill material and deposited most of it on the runway.

b. Runway: Several tons of debris, including up to 8 inches of sand and coral, were deposited on the Tern Island runway during the two December storms. Since the runway is one of the only links to civilization, repair was imperative. A steel I-beam drag was constructed and pulled behind the backhoe to scrape off the debris. The debris proved to be too heavy for the drag, however, so much of it had to be scraped off with the backhoe.

c. Boston Whaler: One of the Boston whalers that was swamped the previous year was completely rehabilitated. Due to the extremely corroded condition, the entire vessel was cleaned and refitted with new parts.

d. Roof: Numerous leaks developed in the barracks roof during the year and required tarring. The results were marginal, with new leaks soon developing. An entire new roof will probably be the only solution.

e. Dry Room: Significant cracks in the "dry room" developed in the exterior walls. In an effort to reduce the relative humidity, the cracks were filled with wood and sealed with waterproof caulking.

f. Generator Building: Both levels of the exterior portion of the generator building were painted with anticorrosive marine paint.

g. Outboard Engine: The 65 hp. Evinrude engine was sent back to Honolulu for repairs.

h. Desalinator: Unknown problems occurred with the desalinator, which resulted in the unit being sent back to Honolulu for repair.

i. Miscellaneous: All exposed hot water pipes were insulated with foam rubber and the support braces were reinforced. Corroded window latches in the barracks building were replaced.

### 3. Major Maintenance

Regular maintenance activities at Tern Island included scheduled servicing of the electrical generators, outboard engines, backhoe, ATV, boat hoist, Boston whalers, fresh water system, salt water system, sewage system, buildings, fuel supplies, refrigeration systems, and the runway. Also included were the servicing of electric and gasoline pumps, water storage tanks, kitchen appliances, and shop tools. The passage of Hurricane Nele required a major effort to dry out the barracks and generator buildings and their contents and to repair wind damage to roofs and wave damage to the boat dock.

### 4. Equipment Utilization and Replacement

Two major purchases for Tern Island included the replacement boat hoist and one generator. The old boat hoist developed electrical problems in addition to structural corrosion. Because the unit became a significant safety hazard, a contract for the construction of a new boat hoist was finalized. Construction was planned for late 1985, but delays postponed construction until January, 1986. Numerous mechanical problems with one of the older generators resulted in the purchase of a replacement. The old generator will be rebuilt and used as an emergency back-up.

Other equipment replacements included the purchase of a steel I-beam for maintaining the runway, a piston arm for the back-hoe, a new cistern pump, three air conditioners, two dehumidifiers, a 70 hp. outboard engine, an electric pump and hose, and a freshwater purifier. New purchases included a slide projector. Major purchases for field camps and biological surveys of other island included an inflatable boat, a 25 hp. outboard, and a 6 hp. outboard.

## 5. Communications System

Since Tern Island is a remote field station with the nearest assistance 500 miles away in Honolulu, radio communication plays a key role in the operation of the refuge. Throughout the year, daily radio checks are conducted with the Honolulu office, except over weekends and on holidays. Due to the location of Tern Island, it also conducts radio checks with seasonal field camps at Laysan and Lisianski Islands and Pearl and Hermes Reef and relays information to Honolulu. In addition to the single side band radio, a VHF radio allows refuge staff members to communicate with local fishing boats and pass on information if required.

Several incidents during the year required communication with the Honolulu refuge staff during non-working hours and assistance was provided by the U.S. Coast Guard. In order to maintain such reliable means of communication with the Coast Guard, a weekly radio check was established on an assigned frequency. The Coast Guard has proved very helpful in relaying information and establishing phone patches when needed.

The Non-Directional Beacon (NDB) transmitter that broke down in 1984 was repaired in Honolulu and returned to Tern Island. The unit aids aircraft in determining the location of the island and is required by the OAS. The unit has been continually plagued with electrical and antenna problems. A new type of antenna is being considered for 1986. Three other communication units required repairs in Honolulu, including the Motorola single side-band radio, the antenna coupler, and several hand-held radios.

Numerous hours were spent maintaining the antenna systems for the NDB, single side-bands, VHF, and hand-held radios. In addition to normal maintenance, a major interference developed with the use of the single side-band radio in Honolulu. After many hours of troubleshooting with the assistance of the FBI and the FCC, refuge staff discovered the problem to be a defective generator fuse in the municipal power generation plant across the street from the Federal building.

Four hand-held VHF radios were purchased for use by field camp personnel to enable communication between islands and with support vessels.

## 7. Energy Conservation

Due to the remote location and geography of Tern Island, and because of government regulations, logistical problems and safety hazards, the supply of fuel is a major problem. Tern Island generators consume about 500 gallons of diesel fuel per month. Storage levels fell below that point several

times. A fuel rationing plan was developed, resulting in less power consumption and less operational time for the generators.

After several small deliveries by a fishing boat, arrangements were made with the U.S. Coast Guard to deliver diesel fuel in October. During the two-day delivery, 10,000 gallons of fuel were ferried by small work boats (500 gal/trip) from the buoy tender SASSAFRAS to Tern Island and pumped through the new fuel lines. That shipment should be enough for about 1 1/2 years, which is about the maximum shelf-life of diesel. The delivery effort was a good example of federal interagency cooperation. The U.S. Coast Guard provided free delivery for the fuel and the U.S. Army provided a pump, three 500 gallon fuel bladders, and the on-site services of a Fueling Specialist, again at no cost to the Service. The assistance of both agencies was greatly appreciated. Commercial delivery of the fuel would have cost over \$30,000.



One of two U.S. Coast Guard workboats which ferried 10,000 gallons of diesel fuel from the Buoy Tender SASSAFRAS to Tern Island. Note the 400-gallon bladder amidship which was one of three provided by the U.S. Army for the refueling operation. Fuel is stored at Tern Island in the tanks in the background. RCW

Deliveries of gasoline, aircraft fuel, and motor oil in 55-gallon drums also took place during the year aboard fishing and research vessels.

Fuel was conserved by installing several skylights in the tool shop, consolidating the use of freezers, and reducing the number of biological trips to the outer islands of the atoll.



The Research Vessel MELVILLE (Scripps Institute of Oceanography) provided transport for three drums of gasoline to Tern Island. DKM

#### 8. Other

Considerable time was spent by the refuge staff coordinating flights and boat trips to support Tern Island. Logistical support flights by plane included one or more flights per

month for a total of 18. Normally, flights are scheduled every 36 days for the delivery of fresh food, supplies, mail, and personnel. Additional flights were funded by the National Marine Fisheries Service, National Weather Service, and an insurance company investigating the sinking of the CAROLYN K.

Fishing and research vessels also played a key role in the support of Tern Island. The fishing vessels FERESA, ALASKA OHANA, and ELLIE B provided free transport of supplies, food, fuel, mail, equipment, and personnel. In addition, the research vessels KILA (State of Hawaii), TOWNSEND CROMWELL (NOAA), and MELVILLE (Scripps Institute of Oceanography) transported similar items. The U.S. Coast Guard buoy tender SASSAFRAS also delivered fuel, supplies, and personnel.

#### J. OTHER ITEMS

##### 3. Items of Interest

On February 5, the 39 ft. fishing vessel CAROLYN K, containing several thousand gallons of diesel fuel, struck a reef at French Frigate Shoals and began taking on water inside the lagoon and well inside the refuge boundary. A few hours later, the three crew members abandoned ship and were rescued by the refuge staff (Biological Technician Eilerts and Volunteer Robin Hanford) about three miles south of Tern Island. The anchored vessel continued to take on water and eventually flipped over. Air trapped in the bow compartment prevented the vessel from sinking, but strong winds and swell drove it toward Tern Island during the next few days. An estimated 200 gallons of diesel fuel were leaked. Fortunately, aerial and surface surveys revealed no damage to fish or wildlife populations. The CAROLYN K. was eventually secured by a salvage vessel (HOLOKAI) 1-1/2 miles south of Tern Island. On February 13, it was refloated and towed to Honolulu. The salvage effort, including a flight by the insurance agent to Tern Island to interview the crew and refuge staff and to transport the crew back to Honolulu, was conducted under Special Use Permit HWN-2-85. The facts have yet to be made public because the insurance company has taken the owner to court, but it appears the CAROLYN K, under steerage by the autopilot, hit a reef while the crew was sleeping. The captain and first mate may then have tried to scuttle the vessel by cutting the water intake hoses, to secure a higher insurance payment.

The incident illustrates the vulnerability of the refuge to vessel groundings and spills and emphasizes the need for vessel monitoring and the need for refuge staff to quickly react to emergency situations involving human safety and the protection of wildlife and habitat resources.

JOHNSTON ATOLL NWR

ANNUAL NARRATIVE REPORT

Calendar Year 1985

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

INTRODUCTION

Johnston Atoll National Wildlife Refuge is located in the Central Pacific Ocean, 717 nautical miles southwest of Honolulu and 460 nautical miles south of French Frigate Shoals. Because of the great distances to the nearest islands in all directions, Johnston Atoll serves an ocean area of 820,000 square miles. It is a coral atoll of approximately 32,000 acres of shallows with four small islands totaling 691 acres. Two of the islands, North and East, were man-made from dredge spoil in the early 1960's. Beginning in the 1940's, Johnston and Sand Islands were also greatly enlarged by landfill. Johnston Island is presently inhabited by approximately 700 military and civilian contractor personnel while Sand Island is the duty station for 11 Coast Guard personnel who live on Johnston Island. One Refuge Biologist was stationed on Johnston Atoll during the period of this report, the first permanent FWS presence on the island since the 1926 Refuge designation. Operational control of Johnston Atoll as a strategic military installation is maintained by the Defense Nuclear Agency, Department of Defense. Johnston Island is also utilized by the U.S. Army as a storage facility for chemical munitions.

The refuge was established in 1926 by Executive Order (No. 4467) of President Calvin Coolidge "as a refuge and breeding ground for native birds". At present, the refuge is managed as nesting and roosting habitat for about 47 species of seabirds, shorebirds, and waterfowl, and as habitat for a diverse assemblage of marine animals, including the threatened green sea turtle and the endangered Hawaiian monk seal.



0 3000 yards  
 0 3000 meters  
 CONTOURS IN FATHOMS

**JOHNSTON ATOLL NATIONAL WILDLIFE REFUGE**  
 North Pacific Ocean

UNITED STATES  
 DEPARTMENT OF THE INTERIOR  
 Fish and Wildlife Service

JOHNSTON ATOLL NATIONAL WILDLIFE REFUGE

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| 4.  | Interpretive Foot Trails.....               | NTR |
| 5.  | Interpretive Tour Routes.....               | NTR |
| 6.  | Interpretive Exhibits/Demonstrations.....   | 19  |
| 7.  | Other Interpretive Programs.....            | 19  |
| 8.  | Hunting.....                                | NTR |
| 9.  | Fishing.....                                | 20  |
| 10. | Trapping.....                               | NTR |
| 11. | Wildlife Observation.....                   | NTR |
| 12. | Other Wildlife Oriented Recreation.....     | NTR |
| 13. | Camping.....                                | NTR |
| 14. | Picnicking.....                             | NTR |
| 15. | Off-Road Vehicling.....                     | NTR |
| 16. | Other Non-Wildlife Oriented Recreation..... | NTR |
| 17. | Law Enforcement.....                        | 20  |

PUBLIC USE (cont.)

- 18. Cooperating Associations.....NTR
- 19. Concessions.....NTR

I. EQUIPMENT AND FACILITIES 21

- 1. New Construction.....NTR
- 2. Rehabilitation.....NTR
- 3. Major Maintenance.....NTR
- 4. Equipment Utilization and Replacement.....NTR
- 5. Communications Systems.....NTR
- 6. Computer Systems.....NTR
- 7. Energy Conservation.....22
- 8. Other.....22

J. OTHER ITEMS

- 1. Cooperative Programs.....NTR
- 2. Other Economic Uses.....NTR
- 3. Items of Interest.....NTR
- 4. Credits.....NTR

K. FEEDBACK NTR

## A. HIGHLIGHTS

1985 saw the establishment and filling of the first full-time position on the Johnston Atoll National Wildlife Refuge since Refuge designation in 1926. The position of Refuge Biologist was established with funds provided by the U.S. Army Toxic and Hazardous Materials Agent (USATHAMA) to monitor refuge resources and populations during the building of the Johnston Atoll Chemical Agency Disposal System (JACADS) facility, and to provide environmental guidance and support to the Base Command. One of the prime responsibilities of the Refuge Biologist is to provide environmental education and refuge awareness to the large influx of personnel associated with the JACADS construction. The position was filled on July 29, and the Refuge Biologist was on station August 15 (Section E.1).

Monitoring of refuge populations was also conducted by three teams of contract researchers: Seabird Research Inc., the National Marine Fisheries Service green turtle research team, and the Hawaii Cooperative Fisheries Research Unit (HCFRU) aquatic resources survey team (Section G).

1985 was the first year with above normal rainfall in several dry years and vegetation growth was lush. 1985 also recorded the first occurrence of a lesser scaup and the first records in many years for several other bird species (Section B).

## B. CLIMATIC CONDITIONS

Johnston Atoll (JA) has a mild tropical oceanic climate dominated by the cooling northeast tradewinds. Weather observations are taken on Johnston Island at a National Oceanic and Atmospheric Administration site adjacent to the airfield. Weather observations and tidal data are also recorded by a remote station located at the main boat dock, and relayed at intervals by satellite link to the National Weather Service in Honolulu.

Data for 1984 were unavailable for inclusion in the 1983/84 report so they are summarized on the following page, as are the data for 1985.

|             | <u>1984</u>         |                        |  |
|-------------|---------------------|------------------------|--|
|             | Yearly<br>Average   | Departure<br>From Mean | Highs<br>and Lows                                  |
|             | -----               | -----                  | -----  |
| TEMPERATURE | 80.6 <sup>o</sup> F | +1.1 <sup>o</sup> F    | 69 <sup>o</sup> F (Feb)<br>90 <sup>o</sup> F (Oct) |
| RAINFALL    | 18.71"              | -8.60"                 | .39" (Mar)<br>2.94" (Aug)                          |
|             |                     |                        |  |
|             | <u>1985</u>         |                        |  |
|             | Yearly<br>Average   | Departure<br>From Mean | Highs<br>and Lows                                  |
|             | -----               | -----                  | -----  |
| TEMPERATURE | 77.9 <sup>o</sup> F | -1.6 <sup>o</sup> F    | 62 <sup>o</sup> F (Dec)<br>90 <sup>o</sup> F (Sep) |
| RAINFALL    | 30.36"              | +3.05"                 | .58" (Feb)<br>5.23" (Nov)                          |

Annual rainfall totals may not give the best insight into how available rainfall affects vegetation, and thus nesting habitat. In 1984, 175 days had measurable (more than 0.01") rainfall, but the 12 monthly maximum days accounted for 33% of the total annual rainfall. Much of the rain is concentrated in passing storm systems and is probably not completely usable due to rapid drainage and lack of a watertable. In 1985 this uneven distribution was even more pronounced, with only 167 days having measurable rain, and 46% of the total annual rainfall being delivered in just twelve days. Nevertheless, at least half of the rain is delivered in passing tradewind showers occurring (on average) every two to three days throughout the year.

The low rainfall for 1984 may be a lingering effect of the 1982/83 El Nino Southern Oscillation (ENSO) which made 1983 an extremely dry year (just 13.99"). In contrast, 1985 bettered the long-term average slightly, with somewhat more rain than normal in the usually drier months and generally normal amounts in the usually wetter months. Availability of greater-than-average rain through the drier months probably contributed to unusually lush growth of vegetation, particularly grasses, on Sand and East Island. (See F.6., "Other Habitats", for further discussion.)

## D. PLANNING

### 2. Management Plan

As a result of the Johnston Atoll Implementation Plan signed in 1984 between Corps of Engineers - Pacific Ocean Division (COE-POD), USATHAMA, DNA Field Command Johnston (FCJ), and FWS, Refuge Complex personnel worked closely with these agencies on refuge environmental concerns arising from the JACADS project. On March 13, Refuge Manager Leinecke met with Mr. Richard Rife of USATHAMA to arrange funding and logistics support for the Refuge Biologist position and to define the Interpretation and Education (IR and EE) program to be developed for the JA population.

In November and December, a Recreational Fishing Plan and required documentation were drafted and reviewed. This plan was required since the refuge was open for fishing but lacked a Fishing Plan. Public Access and Use regulations governing fishing on the refuge had been published in 1976 (Federal Register 41091), so an existing framework of regulations was in place. In addition, the extensive data collection of the Hawaii Cooperative Fisheries Research Unit (HCFRU) Johnston Atoll Aquatic Resources Study provided a firm scientific basis for concluding that refuge populations of fish and invertebrates could easily withstand current and anticipated harvesting pressure. The Fishing Plan was submitted for Regional Office approval in January 1986.

### 3. Public Participation

Refuge Complex personnel attended the JACADS public workshop held April 23 in Honolulu, and the November 7 Honolulu EIS Public Hearing on the deep ocean disposal of JACADS stack scrubber brine. No public questions or comments concerning the refuge were raised at either meeting.

### 4. Compliance with Environmental and Cultural Resource Mandates

In October the Refuge Biologist and Refuge Manager (Remote Islands) reviewed the Draft Environmental Impact Statement (DEIS) for designation of a deep ocean disposal site for JACADS scrubber brines and solid wastes. The major concern centered on barge transport of the brine from the JACADS plant, through the lagoon, and out the main channel to the open ocean. The barge's design, low power, and operating scenario raised the possibility of an accidental grounding in the narrow, surging channel with subsequent release of brine into the lagoon environment. The composition of stack scrubber brines (ionic salts and heavy metals) suggested the possibility of long-term contamination of the reef

environment as well as immediate reef mortality if a spill were to occur. While agreeing that deep ocean disposal was the best disposal alternative, FWS recommended barge design and operating procedure be reviewed more thoroughly to provide the safest possible transport from dockside to deep ocean. This safety margin is particularly important because of the two threatened and endangered species (green sea turtle and Hawaiian monk seal) resident in the refuge lagoon. Other concerns included possible use of the West Channel (and any associated dredging required) and construction of the brine pipeline across a portion of Johnston Island. Pipeline construction could cause disruption to nesting seabirds and the break and spill potential along the route could affect a significant portion of the island's nesting habitat.

##### 5. Research and Investigations

This year saw continuation of several major research projects initiated in earlier years. All were designed to assess potential impacts of the JACADS project on endangered species and refuge resources and populations. The three major contract research programs supported by funds from USATHAMA and administered by the COE - POD were the green sea turtle monitoring of Mr. G. Balazs of the National Marine Fisheries Service, the seabird monitoring studies of Dr. R.W. Schreiber and E.A. Schreiber of Seabird Research Inc., and the Aquatic Resources Study of the FWS Hawaii Cooperative Fisheries Research Unit (HCFRU).

##### JHN-1-85 Sea Turtle Monitoring Studies

Two refuge visits by National Marine Fisheries Service (NMFS) personnel were made to monitor the status of green sea turtle populations (a threatened species) which were first studied at Johnston Atoll in 1983. The first visit by D. Alcorn was made under Special Use Permit (SUP) JHN-1-85 between May 16 to 23 and included shore observations and censuses of all islands to check for basking, tracks or pits. Approximately 15 turtles were observed at one time in the area south of Johnston Island, which had been identified as the primary forage area. No turtles or evidence of basking or nesting were observed on any beaches.

A second NMFS team (G. Balazs, D. Alcorn, R. Forsyth, R. Westlake, R. Watson, and L. Consiglieri) visited from August 29 to September 12 under SUP JHN-2-85 for a more extensive assessment.

Turtles were caught in large-mesh tangle nets set in the most productive area off the south shore of Johnston Island. These were weighed, measured, and tagged. Gut contents were

sampled, and bone and lamina biopsies were taken. For the first time, a portable livestock electro-immobilizer was used to restrain turtles during handling and sampling. This device minimizes force and risk to turtles and researchers. Recovery was instantaneous when the electronic pulses were turned off. Turtles handled with this device displayed no distress, and swam vigorously when released.

No recaptures of turtles tagged in 1983 or during the current visit were made. The population must be well in excess of the thirty turtles tagged. Catch per effort with the nets was equivalent between 1983 and 1985 but since 1985 net sets were in the most productive areas known, while 1983 netting included areas with no captures, actual number of turtles present in 1985 was probably lower than in 1983. Also, fewer turtles were observed at any one time in 1985 versus 1983. Seasonal and random differences may account for this, but with so few data no firm conclusions could be drawn. Food samples were dominated by the same green algae as before, but a new JA record, the marine angiosperm Halophila ovalis, was obtained. Recommendations to continue monitoring this population and continue educating JA residents and visitors on the protected status of the turtles have already been implemented by the Refuge Biologist. (See also Endangered Species.)

#### JHN-2-85 Seabird Monitoring Studies

The primary goal of the seabird research was to assess the size and "health" of refuge populations pre-JACADS. Other goals included the development of predictive capabilities, the ability to detect any JACADS-induced perturbations, and the identification of significant mitigation or enhancement measures for affected species. Ten major questions were posed to achieve these goals: total and breeding population size/species, numbers of nests and young raised to fledgling, egg size, growth rates of young, types of nest sites, diet, rates and causes of mortality, and susceptibility to human disturbance.

The research team visited the refuge on February 22 to March 6, June 20 to 27, July 18 to 25, and October 7 to 14. Birds were counted; nests were identified, characterized, and marked with numbered stake tags; eggs were measured and weighed; chicks were measured, weighed, and molt staged; and regurgitation samples were taken and frozen. Population, nest, and fledgling numbers are shown in the "Wildlife" section under "Shorebirds, Gulls, Terns, and Allied Species" (G.5), Table II. Most populations appeared to be stable (within the confidence of the estimates) or to have shown a slight increase over 1984. Fledgling success appears high in most species, and regulations and protection generally seem to contribute to high productivity. Except for the greater frigatebirds, the unnatural mortality from LORAN

tower guy-wire strikes does not appear to be having a significant impact on populations.

Recommendations from this study included continued monitoring and banding, education of island personnel to avoid disturbing nests, and curtailing brush clearing. These have already been implemented by the Refuge Biologist. Other long-term recommendations such as baseline tissue contamination determinations and monitoring of seabird feeding at open ocean dump sites are being investigated.



Red-footed booby on nest number 709 marked by Seabird Research on East Island. WJC

#### JHN-3-85 Aquatic Resources Survey

The Aquatic Resources Survey (by HCFRU) will be discussed in Habitat Management, section G.

### E. ADMINISTRATION

#### 1. Personnel

For the first time since Refuge designation in 1926, a position for a full-time FWS employee stationed on the

refuge was established and filled. The position was a temporary Fish and Wildlife Biologist (GS-401-9) funded by USATHAMA. It was filled with the hiring of Dr. William J. Cooke, effective July 29. The position has five major responsibilities: monitoring and associated research on refuge populations; advice and support to the JA base and tenant commands on environmental and refuge concerns; providing interpretation and education programs for JA residents and visitors; liason and coordination with visiting researchers; and planning, budgeting and managing refuge resources to achieve these goals..

#### 4. Volunteer Program

Several soldiers and civilians expressed an interest in assisting the Refuge Biologist with bird banding duties and marine research. Some of these individuals were certified SCUBA divers (one as an instructor!) and all expressed a strong interest in natural history and the biology of the species found on the refuge. Trial use indicated they would be excellent assistants, and volunteer agreements were concluded in late 1985.

#### 5. Funding

The FWS program at JA--including the Biologist position, operational support money, and the cost of the seabird, turtle and aquatic resources monitoring programs--are funded entirely by USATHAMA. \$40,000 was provided in the latter part of FY85 for initial hire of the Refuge Biologist, equipment and supplies, and establishment of the refuge office. In FY86 a first quarter funding of \$10,000 was provided for salary and expenses. In addition, \$2,500 was provided to a COE on-island support account for quarters, subsistence, office rental, and other on-island expenses. All JACADS environmental studies (HCFRU, Seabird Research, etc.) also use this same COE overhead account for similar expenses and provide similar amounts from their overall contract.

### F. HABITAT MANAGEMENT

#### 1. General

Johnston Atoll serves primarily as roosting and breeding grounds for Central Pacific seabirds, as wintering grounds for migratory shorebirds, as haven for straggler waterfowl and other birds, and as a unique coral reef ecosystem combining elements of Hawaiian and Central Pacific reef

communities. The importance of Johnston Atoll can best be appreciated by viewing Fig. 1 (see following page) which shows the Johnston Atoll "ocean area". This is defined as the area bounded by mid-point distances to surrounding islands in all directions. These are the Hawaiian chain, including the Northwest Hawaiian Islands to the north; Palmyra and Howland to the south and southeast; and Arno, Mejit, Bikar, and Taongi Atolls in the eastern Marshall Islands to the west. The northwest side is equidistant from Johnston, Wake and Laysan. Within this area, Johnston Atoll is the only island available as a roosting and breeding ground for seabirds exploiting the central Pacific. This "ocean area" covers 820,000 square miles and represents approximately one-quarter of the tropical Central Pacific (145° E - 145° W). The importance of Johnston Atoll in the ecology of the Central Pacific is far greater than its relatively small land mass would at first suggest. Within this overall area, the areas most intensively foraged by Johnston Atoll bird colonies are probably controlled by food availability and oceanographic conditions, particularly the down-current "wake" of Johnston Atoll.

#### 6. Other Habitats

On January 7, an artificial reef was created at Johnston Atoll under a permit (PODCO-0 1792-S) granted by the U.S. Army Corps of Engineers. The structure is sited approximately three miles SSW of Johnston Island on flat, featureless sandy bottom approximately 60 feet deep and consists of the steel hulls of three LCM's (Mike boats) loaded with motor vehicles, heavy equipment, and large appliances. The disposed items were free of petroleum, toxic substances (including radioactive materials), flammables, and floatables and were placed within a 50-meter radius to maximize vertical topography. Periodic SCUBA surveys of the site are planned to determine the value of the structure as habitat for fishes and invertebrates.

The marine habitat (reefs supporting invertebrate and fish populations) of the refuge were thoroughly characterized by the HCFERU Aquatic Resources Survey conducted in 1984. Their report was received in early 1985 and analyzed and evaluated by the Refuge Biologist and Refuge Manager (Remote Islands). This survey sampled 113 stations throughout the atoll describing bottom communities and counting fish at each station. The individual stations were grouped into 12 habitat zones (nearshore, channel, outer reef, etc.) based on location and common features. Each station and the overall zones were characterized as to kind and amount of coral cover, cover of other macroinvertebrates, and general structure (species, dominance, and abundance) of the fish community. In addition, abundances of particular fish species were also noted at each station. These data provide a baseline against which future changes in community



composition or species abundance may be evaluated.

Although the 12 different zones are clearly differentiated, general abundances and relative importance of common species of both coral and fish are quite consistent throughout the atoll. Acropora and Montipora species dominate the coral community, with Acropora cytherea being especially dominant in areal coverage. This species, commonly called "table coral", can attain 100% cover in many areas, is probably one of the fastest growing coral species, and provides extensive three-dimensional habitat for many different fish. The fish community is also dominated by relatively few species.



Large colony of Acropora cytherea, the tabletop coral, showing distinctive growth banding which probably represents annual increments. This is the most abundant coral species in the Johnston Atoll lagoon. WJC

Table I shows the eleven most abundant fish species on JA. The HCFRU report also noted that the six dominant surgeonfishes (Acanthuridae) are especially widespread and consistently found in most zones, while others (Butterflyfish - Chaetodontidae) were more variably distributed between zones.

While the marine habitat appeared healthy and at minimal risk, the terrestrial habitat, particularly nesting habitat

TABLE I -- RANKING OF 11 MOST ABUNDANT FISH  
AT JOHNSTON ATOLL

| RANK | SPECIES                          | English                 | Hawaiian/Johnston |
|------|----------------------------------|-------------------------|-------------------|
| 1    | <u>Scarus sordidus</u>           | Bullethead parrotfish   | 'uhu              |
| 2    | <u>Ctenochaetus strigosus</u>    | Yelloweye surgeonfish   | kole              |
| 3    | <u>Acanthurus nigroris</u>       | Blueline surgeonfish    | maiko             |
| 4    | <u>Naso lituratus</u>            | Orangespine unicornfish | kala              |
| 5    | <u>Melichthys niger</u>          | Black triggerfish       |                   |
| 6    | <u>Acanthurus achilles</u>       | Achilles tang           | pakuikui          |
| 7    | <u>Megaprotodon trifascialis</u> | Chevron butterflyfish   |                   |
| 8    | <u>Thalassoma duperrey</u>       | Saddle wrasse           | hinalea lauwili   |
| 9    | <u>Dascyllus albisella</u>       | Whitespot damselfish    | aloiloi           |
| 10   | <u>Chaetodon auriga</u>          | Threadfin butterflyfish | lau lau           |
| 11   | <u>Acanthurus triostegus</u>     | Convict surgeonfish     | manini            |

(After Dee, Irons, and Parrish, 1985)

for seabirds, faced considerable risk during 1985. During initiation of two major construction projects, the munition storage "Igloos" and the JACADS facility, significant acreage utilized by under-brush nesting red-tailed tropicbirds was lost on JA. The Refuge Biologist worked closely with the JA Base Engineer and the construction contractors during clearance of this brush (primarily Pluchea odorata and P. indica). Clearance was scheduled to occur during the non-breeding season, although the presence of some unsynchronized breeders complicated operations. In these areas (used for aggregate stockpiles and materials storage yards) active nests were identified and marked by the contractors under the guidance of the Refuge Biologist. Heavy equipment operators were also briefed on avoiding the location of the nests. Although brush areas containing over one-hundred nesting sites were cleared, no active nests were lost, and no mortality was incurred. Monitoring of birds which had used these sites will determine if they shift to un- or under-utilized brush areas on Johnston Island or other islands.



Files of aggregate stockpiled west of the RED HAT AREA and IGL00 construction site, which resulted in loss of significant brush nesting habitat for red-tailed tropicbirds. This area was formerly covered with vegetation like that in mid-background (which has also since been cleared). WJC

Preliminary findings by Ralph Schreiber of Seabird Research identified a lack of nest and roost sites for red-footed boobies and greater frigatebirds. In response, one hundred and fifty concrete cinder blocks were moved to the north side of East Island. Here they provided off-ground bases for red-footed booby nests and roosting perches for greater frigatebirds away from the hazard of the LORAN tower guy-wires over Sand Island. Monitoring in late 1985 showed most of these blocks were already being used by these two species. The higher than normal rainfall in 1985 contributed to the lushest growth of vegetation seen in many years. This provided good shade cover under bushes for red-tailed tropicbirds and high grass which could shade some sooty tern sites. However, the lush grass cover could actually reduce sooty tern nest availability by being so high as to keep birds off the ground surface. The net effect of this lush vegetation is still unknown.

## G. WILDLIFE

### 2. Endangered and/or Threatened Species

The refuge supports populations of the green sea turtle (threatened) and the Hawaiian monk seal (endangered). The status of refuge populations of the green sea turtle was discussed in D.5 - Research and Investigations (above). One notable finding in 1985 was the recovery at French Frigate Shoals in the Hawaiian Islands NWR (HINWR) of an adult female tagged at Johnston Atoll in 1983. This tag recovery indicates that at least some of the population foraging on Johnston Atoll migrate to the Northwestern Hawaiian Islands for breeding. However, turtles tagged at French Frigate Shoals were never recovered at Johnston Atoll during the period when take was legal and many were taken. This suggests that some of the refuge population migrates to other island groups besides the Northwestern Hawaiian Islands for breeding.

Hawaiian monk seals were known in historical times to use Johnston Atoll intermittently in very low numbers (migrating from HINWR). Of the nine Hawaiian monk seals translocated from HINWR to the refuge in 1984, only two were seen. The others have either migrated back to the Northwestern Hawaiian Islands (NWHI), or perished. Natural migrations are certainly within the species' capabilities, but the seven missing seals have not been resighted in the NWHI despite an extensive observation program. Individuals currently resident at JA lost their coat bleach marks by late 1985 so continued monitoring will require reading their metal flipper tags. The Refuge Biologist (with the assistance of many island residents) monitors and logs seal

sightings on the beaches of the four islands.

The protected status of seals and turtles is specifically stressed to all visitors as well as in the newcomers briefings given to all incoming permanent personnel.

### 3. Waterfowl

Although the refuge supports no wetland habitat, occasional straggler and accidental waterfowl are recovered at the start of winter migrations. Four pintails (Anas acuta) were recovered in 1985. One was found oiled, and though treatment and deoiling were attempted by the Refuge Biologist and the Holmes and Narver physician, the duck died. The light, thin consistency and other characteristics of the oil suggested this bird may have become oiled on a floating slick. One of the other three pintails was a road kill, and the remaining two presumably departed after recovering (feeding at areas maintained by island residents for migratory shorebirds).



Dorsal and wing view of the first lesser scaup (Aythya affinis) ever recorded from JANWR. This bird was collected at Johnston Island in November 1985 and rehabilitated with the help of island residents. WJC

Of special interest was the recovery of the first lesser scaup (Aythya affinis) ever recorded at JA. No previous

sightings of this species exist in literature or refuge records, and this finding extends the extreme range of the species (which is found in the main Hawaiian Islands) well to the west and south. The specimen was collected in an emaciated condition by a Military Police patrol and turned over to the Refuge Biologist. The bird was rehabilitated in captivity and released. The bird presumably departed the atoll.

#### 5. Shorebirds, Gulls, Terns, and Allied Species

All four islands of Johnston Atoll are used as roosting and/or breeding grounds for at least some of the 14 species of seabirds using the refuge. The white-tailed tropicbird was added to the list of breeding species in 1985 on the basis of several nests observed by the Refuge Biologist and the Schreiber research team, although no young fledged from these nests. The masked booby was present as a non-breeding, roosting population using East Island. Since this species bred on Johnston in the recent past, it is likely it will attempt breeding again, perhaps in the near future. The results of the extensive censuses of the Schreiber research team are presented in Table II and represent the best estimates of population (as one day maxima).

TABLE II

#### 1985, SEABIRD POPULATION ESTIMATES FOR JOHNSTON ATOLL

| Species                 | Adults | Nests  | Young  |
|-------------------------|--------|--------|--------|
| Bulwer's petrel         | --     | 8-10   | --     |
| Wedge-tailed shearwater | 2,000  | 1,000  | 600    |
| Christmas shearwater    | 60     | 30     | --     |
| Red-tailed tropicbird   | 1,300  | 650    | 630    |
| White-tailed tropicbird | 6      | 3      | --     |
| Brown booby             | 340    | 150    | 140    |
| Red-footed booby        | 500    | 300    | 80     |
| Masked booby            | 20     | --     | --     |
| Great frigatebird       | 1,000  | 30     | 40     |
| Gray-backed tern        | 120    | 60     | 50     |
| Sooty tern              | 36,000 | 18,000 | 16,000 |
| Brown noddy             | 2,600  | 1,300  | 1,100  |
| Black noddy             | 80     | 20     | 16     |
| White tern              | 100    | 30     | 22     |

Population estimates for migratory shorebirds using the Refuge as winter feeding grounds are shown in Table III.

table. In addition, the Refuge Biologist logged mortality (21 recorded cases) of the lesser golden plover and provided one specimen for analysis. The cause of death was found to be starvation complicated by bacterial pericarditis.



White-tailed tropicbird incubating under a Casuarina (Ironwood) tree near the west end of Johnston Island. This species normally nests on cliffs on high volcanic islands in the main Hawaiian chain. WJC

TABLE III

## NOVEMBER 1985 SHOREBIRD POPULATIONS AT JANWR

| Species                | Number (Daily Maxima) |
|------------------------|-----------------------|
| Bristle-thighed curlew | 4                     |
| Golden plover          | 450                   |
| Ruddy turnstone        | 100                   |
| Sanderling             | 5                     |
| Wandering tattler      | 20                    |
| Lesser yellowlegs      | 1                     |

The observation of the lesser yellowlegs was based on one sighting of an individual (best fitting that species) on the beach of Sand Island. Lesser yellowlegs had been previously known from only one collection record in 1963.

#### 6. Raptors

Two short-eared owls were consistently sighted in the vicinity of the "Scientific Row" buildings on Johnston Island. Short-eared owls had been regularly reported from Johnston Island before. It is presumed they feed on the abundant mouse population, since pellets contain only mouse bones. No bird carcasses or attacks on seabirds were ever observed. Reports by island residents of "hawks" in this area were likely sightings of these owls. The presence of another raptor species at some time cannot be completely excluded since at least one, the Peregrine Falcon, has been collected in the past.

#### 9. Marine Mammals

See G.2, Endangered and/or Threatened Species (above).

#### 11. Fisheries Resources

The fisheries resources of the refuge consist of approximately 271 species of fish and many species of coral and other invertebrates which are taken as souvenirs. Of the fish species, the actual take is concentrated on just a few species as shown in Table IV. Although fishing is popular with both military and long-time resident personnel, the latter are responsible for the bulk of the take. These long-time residents have the experience and familiarity with fishing tropical reefs, while newcomers, although enthusiastic and curious, are often not very successful until they learn the local techniques. The impact of this

TABLE IV

RANKING OF 11 MOST ABUNDANT  
CATCH SPECIES AT JOHNSTON ATOLL

| RANK | SPECIES                          | COMMON NAME           |                   | APPROXIMATE ANNUAL<br>TAKE (INDIVIDUALS) |
|------|----------------------------------|-----------------------|-------------------|--|
|      |                                  | English               | Hawaiian/Johnston |  |
| 1    | <u>Myripristis amaenus</u>       | Brick soldierfish     | menpachi          | 3,700                                    |
| 2    | <u>Acanthurus triostegus</u>     | Convict surgeonfish   | manini            | 3,200                                    |
| 3    | <u>Ctenochaetus strigosus</u>    | Yelloweye surgeonfish | kole              | 3,200                                    |
| 4    | <u>Chaenomugil leuciscus</u>     | Chaptall's mullet     | uouoa             | 2,000                                    |
| 5    | <u>Kuhlia marginata</u>          | Pacific flagtail      | aholehole         | 1,400                                    |
| 6    | <u>Parupeneus multifasciatus</u> | Manybar goatfish      | moana             | 900                                      |
| 7    | <u>Parupeneus cyclostomus</u>    | Blue goatfish         | moana kale        | 900                                      |
| 8    | <u>Caranx melampygus</u>         | Blue jack             | papio             | 600                                      |
| 9    | <u>Priacanthus cruentatus</u>    | Glasseye              | aweoweo           | 600                                      |
| 10   | <u>Mulloides flavolineatus</u>   | Yellowstripe goatfish | weke              | 400                                      |
| 11   | <u>Parupeneus bifasciatus</u>    | Doublebar goatfish    | moano papa        | 400                                      |

(After Dee, Irons, and Parrish: 1985)

TABLE V.

Estimated percent of species populations caught annually for the period Jun 85 - May 86.

| SPECIES                            | 1<br>ESTIMATED<br>ATOLL POPULATION | 2<br>ESTIMATED TOTAL<br>ANNUAL CATCH | 3<br>ANNUAL CATCH/POPULATION<br>(%) |
|------------------------------------|------------------------------------|--------------------------------------|-------------------------------------|
| <i>Ctenochaetus strigosus</i>      | 1,650,300                          | 2188                                 | 0.1                                 |
| <i>Acanthurus triostegus</i>       | 599,600                            | 1695                                 | 0.3                                 |
| <i>Myripristis amaenus</i>         | 385,400*                           | 2365                                 | 0.6*                                |
| <i>Mulloides flavolineatus</i>     | 188,900                            | 326                                  | 0.2                                 |
| <i>Pseudupeneus multifasciatus</i> | 61,850                             | 220                                  | 0.4                                 |
| <i>Pseudupeneus bifasciatus</i>    | 48,000                             | 362                                  | 0.8                                 |
| <i>Scarus perspicillatus</i>       | 29,450                             | 328                                  | 1.1                                 |
| <i>Pseudupeneus cyclostomus</i>    | 27,600                             | 307                                  | 1.1                                 |
| <i>Caranx melampygus</i>           | 26,500                             | 607                                  | 2.3                                 |
| <i>Kyphosus vaiigiensis</i>        | 22,350                             | 239                                  | 1.1                                 |

\*The atoll population estimate is probably a considerable underestimate because of its cryptic habits.

recreational fishery is minimal on the atoll-wide populations, as shown in Table V. The most-taken fish in relation to atoll-wide population size still suffers only a 3% annual mortality from recreational fishing. The population estimates were derived from the lagoon surveys of the HCFRU team, while the annual take was estimated from the Catch Report Forms and the Creel Censuses performed by the same research team.



Darby Irons and Steve Poet of the HCFRU team measuring and weighing JANWR reef fish during the Sunday Creel Census. The fish being weighed is the brick soldierfish, known locally as menpachi (*Myripristis amaneus*), which is one of the most highly prized food fish of the recreational fishery. WJC

16. Marking and Banding

Working through the low season for seabirds, the Refuge Biologist banded twenty red-tailed tropicbirds, one white tern chick, one lesser scaup, and three pintails. The extensive banding efforts by Schreiber's Seabird Research team are summarized in the following table (Table VI):

TABLE VI  
1985 BANDING AT JANWR

| Species               | Number Banded |
|-----------------------|---------------|
| Red-tailed tropicbird | 1,053         |
| Brown booby           | 157           |
| Red-footed booby      | 153           |
| Great frigatebird     | 61            |
| Sooty tern            | 128           |
| Brown noddy           | 226           |
| Black noddy           | 1             |
| White tern            | 100           |



Refuge Biologist Cooke banding a red-tailed tropicbird on Johnston Island, JANWR. The brush in the background is Pluchea odorata, one of the favorite nesting habitats for this species. WJC

## H. PUBLIC USE

### 1. General

The population of Johnston Atoll grew from approximately 300 personnel in 1984 to an average of 650-750 military and civilian contractor personnel by the end of 1985. This was due to an increase in security personnel for the chemical munitions storage facility and the initiation of the Igloo and JACADS construction projects. There is no "public" access as such; the base is a restricted installation and all personnel must have orders to the facility and an entry authorization from the Base Commander to debark from any plane or ship. In addition, the atoll is a Naval Defensive Sea Area out to the three-mile limit and no unauthorized vessels are allowed entry to the atoll. All personnel and vessels, whether military or civilian, are under the control of the Base Commander while at Johnston and all regulations (including Refuge Regulations) apply to all personnel.

### 6. Interpretive Exhibits/Demonstrations

A display of wildlife photographs highlighting seabirds and endangered species found on the refuge was installed in the Joint Operations Center (JOC) Building, the island headquarters. The locations of the display, in the hallway next to the base cashier and the chapel, assure high visibility to island residents. In addition, a set of one dozen turtle posters was received from the National Marine Fisheries Service. To acquaint residents and visitors with the protected status of all marine turtles, these posters will be mounted in protected frames and displayed in barracks and dormitory dayrooms for widest contact.

### 7. Other Interpretive Programs

In order that all personnel on the refuge, whether military or civilian, temporary visitors or permanently stationed, are aware of the refuge status of Johnston Atoll, two briefings are provided to all incoming personnel. The first briefing, given at the air terminal, is given to both the TDY and permanent personnel and includes the status of Johnston Atoll as a National Wildlife Refuge, the regulations protecting seabirds and endangered species, and the penalties for violating regulations. The second briefing, for all newcomers permanently stationed (more than 2 months) on this island, is part of the 90-minute introductory program given by the Base Commander and his representatives. The regulations of the refuge are covered again, as is information on the history of the refuge, the reasons for its existence and its importance in the ecology of the Central Pacific, the major species which use the

refuge, and the research projects currently underway. The longer briefing is tailored to providing background information as to why the protection and regulations exist and what each individual's responsibilities are while on the Atoll.

A brochure was drafted in late 1985 which will be specific for JANWR. Until this is available in early 1986, the only brochure currently relevant and available is the Hawaiian and Pacific Islands Complex brochure. Copies of this brochure were shipped to JA in late December 1985 for distribution.

### 9. Fishing

Recreational fishing is a popular activity on Johnston Atoll. The Fishing Plan for the refuge has been covered above (D.2) as have the Fisheries Resources (G.11). In terms of actual public use, the HCFRU survey team estimated approximately 19,000 hours of fishing effort per year on the refuge. Catches are made by hand, by pole and line, by throw net, and by spearfishing while diving. Additionally, fishing parties organized by the Base Recreational Services Office use landing craft ("Mike" boats) and other small craft to troll just outside the refuge boundary for pelagic species such as wahoo (ono) or tunas (ahi and aku).

Base regulations controlling fishing prohibited the use of throw nets within 100 yards of the shoreline of Johnston Island while allowing their use off of other islands. Because catch data from the HCFRU research team showed that recreational fishing has minimal impact, this regulation was examined in a public meeting held in late 1985. The general sentiment was that the regulation worked a hardship on fishermen who could not travel to the other islands (recreational boats were often in high demand). As a result of the HCFRU findings and the sentiment of the resident population, the Refuge Biologist obtained a six-month trial suspension of the regulation from the Base Commander. In early 1986 the results of the opening of the Johnston Island shoreline to fishing will be evaluated and a decision will be made to continue the fishing or to re-impose the restriction.

### 17. Law Enforcement

The Refuge Biologist has no law enforcement authority on the refuge as all enforcement authority is vested in the Base Security Enforcement force. The Refuge Biologist on one occasion observed the illegal use of a gill net, which is prohibited under the Public Use and Access regulations (50 CFR 26.34). The offender was advised of the violation and instructed to turn the net in to the Security Enforcement

Office until it could be removed from the refuge. He complied. The Refuge Biologist also assisted the Security Enforcement captain in his examination of frozen "Home-Packs" of fish taken out by residents returning to Honolulu.

### I. EQUIPMENT AND FACILITIES

The primary FWS facility on the refuge is the Refuge Biologist's office located in the JOC building. The office is adjacent to the Base Engineer's office and one office away from the Base Commander's office. This office was provided and furnished by the base so that the Refuge Biologist could work closely with the Base Command. The office includes desk and chairs, filing cabinets, lab table with microscope, bookshelves, and a couch. The JOC building is completely air-conditioned and highly secure.



The Joint Operations Center (JOC) Building on Johnston Island. The JANWR Refuge Biologist's office is located on the second floor, adjacent to the Base Commander's and Base Engineer's offices. WJC

## 6. Energy Conservation

The Refuge Biologist is provided with a three-speed bicycle for personal transport on Johnston Island. Since the island is only 1/2 mile wide and about 2 miles long, this is adequate for most purposes. For groups and equipment, other vehicles from golf carts to pickup trucks are available from the Base motorpool.

## 7. Other

The Refuge Biologist's office also includes a Bausch and Lomb Stereo-Zoom binocular dissecting microscope on loan from HCFRU and an IBM Mag-Card 6240 word processor which was surplus to the Honolulu office. This machine allows the Refuge Biologist to efficiently draft and produce reports and correspondence with no clerical or secretarial support.

The refuge also purchased with funds provided by USATHAMA a JVC Video System including a SX-770U video camera and a RU-6200 video recorder. This system, along with a recently purchased Canon single-lens reflex (SLR) and a Nikonos underwater camera, will allow the Refuge Biologist to document refuge operations, habitat conditions, research projects, and the impact of any natural or man-made perturbations on wildlife.

BAKER, HOWLAND AND JARVIS ISLANDS NWR

ANNUAL NARRATIVE REPORT

Calendar Year 1985

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

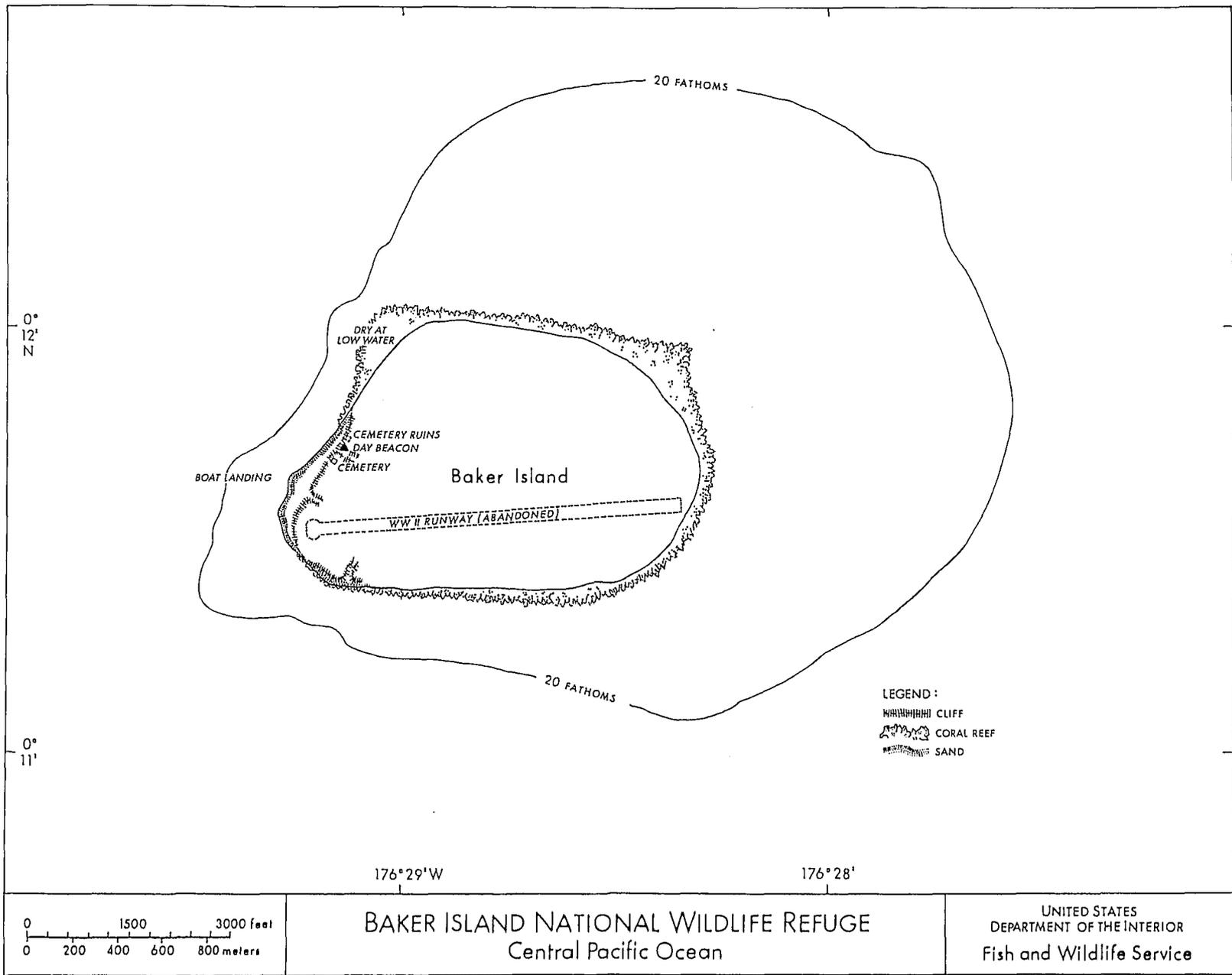
## INTRODUCTION

Baker Island and Howland Island National Wildlife Refuges are isolated coral islands 50 and 20 miles north of the equator in the Central Pacific Ocean about 1,600 miles southwest of Honolulu, Hawaii. Jarvis Island National Wildlife Refuge is located 20 miles south of the equator about 1,300 miles south of Honolulu and 1,000 miles east of Baker and Howland Islands. Baker Island Refuge contains 340 acres of land and 31,397 acres of submerged land and water. Howland Island Refuge contains 400 acres of land and 32,150 acres of submerged land and water. Jarvis Island Refuge contains 1,100 acres of land and 36,419 acres of submerged land and water. All three islands are uninhabited and vegetated only by grasses, prostrate vines, and low-growing shrubs due to scant rainfall, constant wind, and burning sun.

All three refuges were established by the Secretary of the Interior in 1974 when management responsibility was transferred from the Office of Territorial Affairs to the Fish and Wildlife Service. They are managed primarily as nesting and roosting habitat for about 20 species of seabirds and shorebirds.

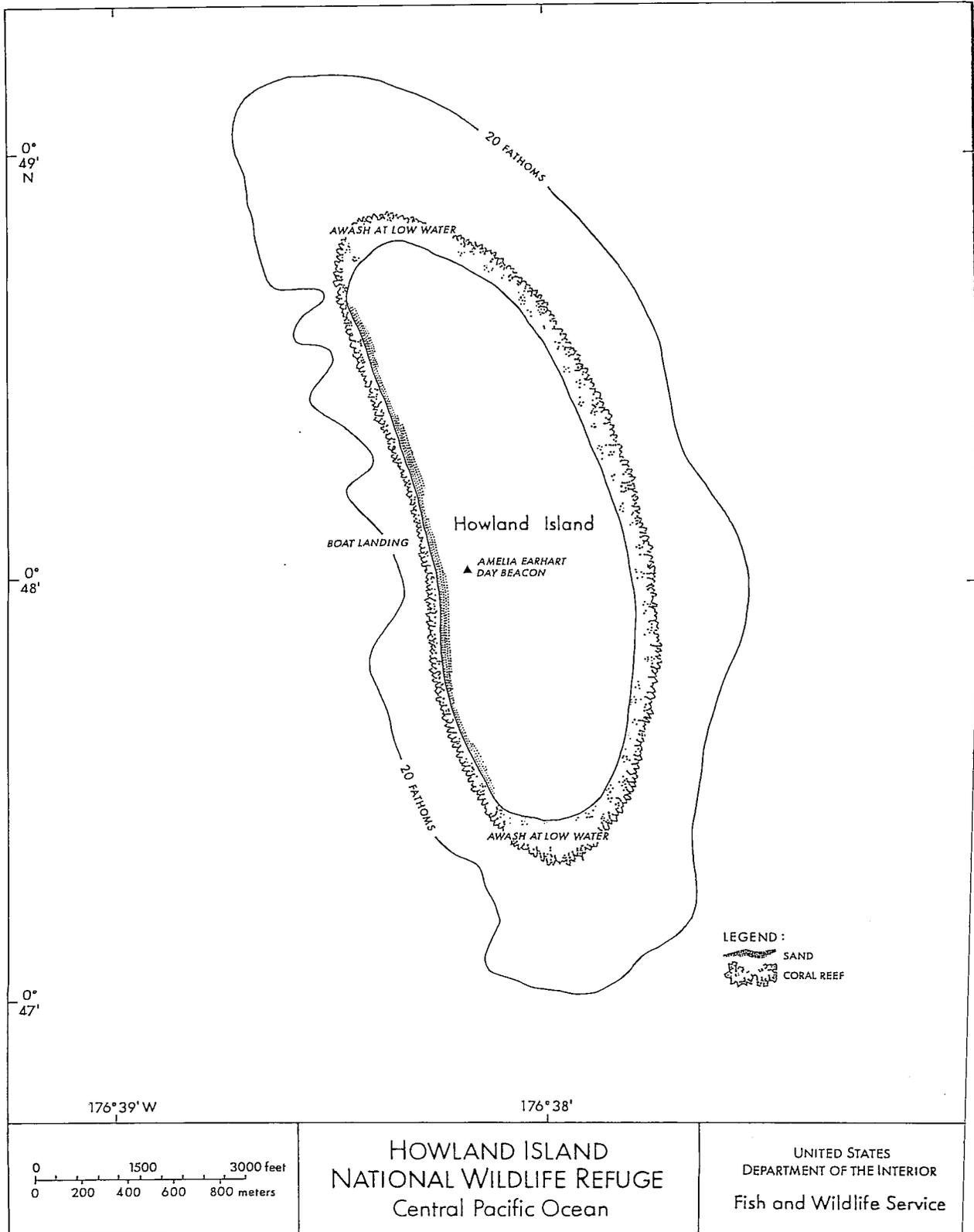


Baker Island NWR. Note the landing strip and trenches containing drums of fuel left by the military at the close of World War II.  
(GW--National Marine Fisheries Service)



BAKER ISLAND NATIONAL WILDLIFE REFUGE  
Central Pacific Ocean

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
Fish and Wildlife Service



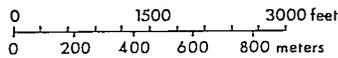
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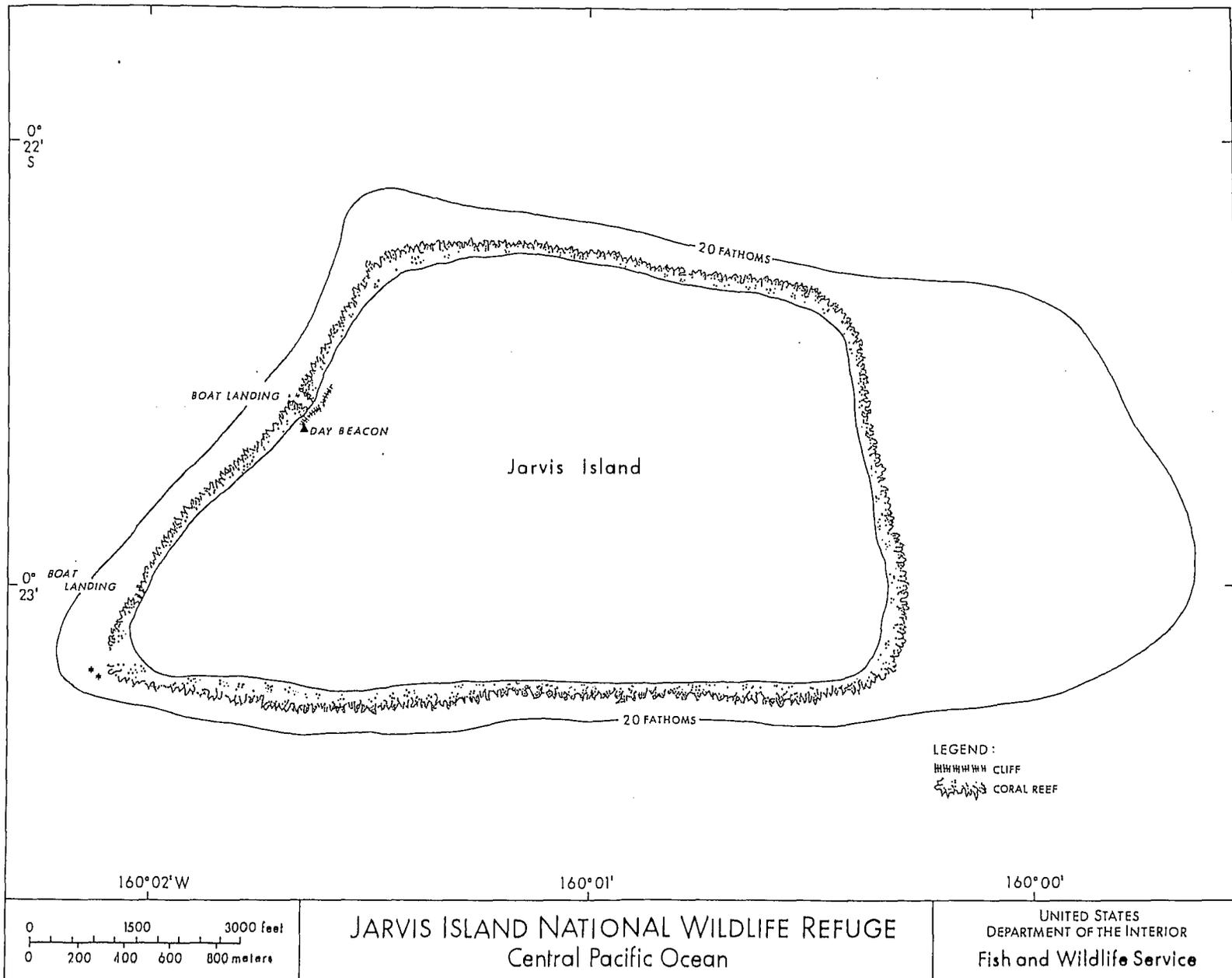
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HOWLAND ISLAND  
NATIONAL WILDLIFE REFUGE  
Central Pacific Ocean

LEGEND:  
 SAND  
 CORAL REEF

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
Fish and Wildlife Service



BAKER, HOWLAND AND JARVIS ISLANDS NATIONAL WILDLIFE REFUGE

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K. FEEDBACK

NTR

## A. HIGHLIGHTS

No visits by FWS personnel, the U.S. Coast Guard or any other individuals occurred at Baker, Howland or Jarvis Island Refuges during 1985. The large expenditure of time and money required to visit these isolated specks of land precludes all possibility of regular trips by refuge personnel to monitor seabird populations and terrestrial and marine habitats. Two refuge staff visits were made to Jarvis Island in 1983 to eradicate feral cats, monitor seabird populations and supervise four amateur radio operators who funded a significant portion of one of the trips. The most recent refuge staff visits to Baker and Howland Islands were in 1980 to monitor seabird populations and habitat.

Two groups had tentative plans to visit these refuges in 1985. A Special Use Permit was issued to a group from the University of Hawaii which planned to install a remote, satellite-transmitting meteorological observing station at Jarvis Island and to exchange oceanographic instruments which measure sea temperature and pressure. Grace McGuire, the avitrix who will attempt a round-the-world flight in an aircraft similar to that in which Amelia Earhart disappeared while flying from New Guinea to Howland Island, was also planning a visit to Howland to determine if an aircraft landing is still possible. Both groups were stymied by lack of funds in 1985 but both plan to try again in 1986.

The refuge staff is also planning 1986 visits to these islands. Funds have been budgeted for a contaminant survey during which drums and debris left by the military and other agencies at Baker and Howland Islands will be inventoried and sampled. Funds have also been budgeted to determine if feral cats exist on Baker Island and to eradicate a known population of cats at Howland Island. Seabird populations and habitats will also be monitored during these efforts.

## B. CLIMATIC CONDITIONS

Climatic conditions at Baker, Howland, and Jarvis Islands are unknown for the reporting period. No remote-sensing instrumentation was operating to furnish meteorological data. Data collected from other Central Pacific locations during the year indicated near-normal conditions with no evidence of the "El Nino" conditions that adversely impacted the Jarvis Island seabird populations in 1982 and 1983.

F. HABITAT MANAGEMENT1. General

Habitat management on each of these islands is based on the philosophy that the resident populations of seabirds and other wildlife will return to a natural state if environmentally destructive conditions resulting from former habitation of the islands are removed or controlled. Past management efforts have taken two forms: control of introduced cats and the destruction of debris. The natural state of these islands is maintained by a restrictive policy of limited entry and of allowing only those activities that would be beneficial to the wildlife populations. The fact that the nearest inhabited island is 240 miles away from Jarvis and 660 miles away from Howland and Baker Islands facilitates this type of management.

ROSE ATOLL NWR

American Samoa

ANNUAL NARRATIVE REPORT

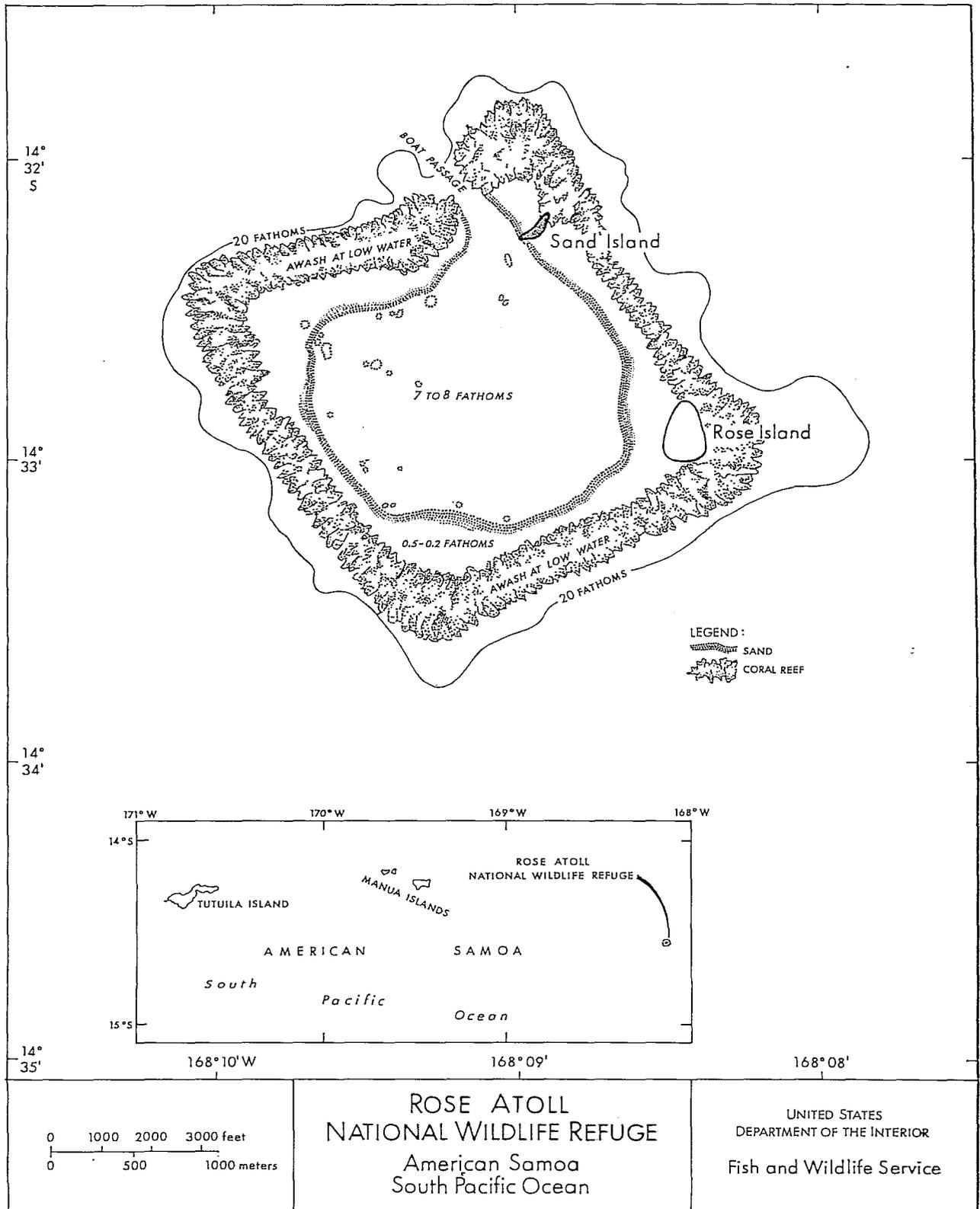
Calendar Year 1985

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

INTRODUCTION

Rose Atoll National Wildlife Refuge is the southernmost unit of the National Wildlife Refuge System located 14 degrees south of the equator in the tropical Pacific approximately 2,500 miles south of Hawaii and 180 miles east of Tutuila Island, American Samoa. It is a coral atoll with 1,593 acres of submerged reef and lagoon and two emergent islands. Rose Island comprises 18 acres and is heavily vegetated with Pisonia trees and Tournefortia shrubs. Sand Island comprises 2 acres and has been unvegetated until recently. Rose Atoll has never been inhabited, though Samoans traditionally fish the nearshore waters.

The refuge was established in 1973 by Cooperative Agreement between the American Samoa Government and the Fish and Wildlife Service and is jointly managed by both agencies. Management objectives are to preserve the marine and terrestrial habitats and associated flora and fauna for scientific study and environmental education and to protect the aesthetic values as part of our national heritage. The atoll is an important nesting area for the threatened green sea turtle and provides nesting and roosting habitat and forage areas for about 15 species of seabirds and shorebirds. Hundreds of species of fishes, corals, and other invertebrates inhabit the shallow reefs and lagoon, including the giant clam (Tridacna maxima) which is highly prized as food by the Samoans.



ROSE ATOLL NATIONAL WILDLIFE REFUGE

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K. FEEDBACK

NTR

RE.

### HIGHLIGHTS

Dr. Richard Radtke, University of Hawaii, agreed to analyze and report on the ecological and stock assessment data collected for the giant clam (Tridacna maxima) within the lagoon at Rose Atoll. These data have been collected by the FWS, the American Samoa Government, and Dr. Radtke on six field trips to Rose Atoll since 1980. The analysis and report will be completed in 1986.

The American Samoa Government has withdrawn its request to open Rose Atoll to a strictly regulated clam fishery. The Government now believes that the resources and habitat should be totally protected and preserved in their natural state for educational, scientific, and cultural purposes.

In an effort to capitalize on the educational and cultural values of the refuge, six Samoan high school science teachers, led by the Department of Education's Science Specialist, visited Rose Atoll in May. The purpose of their trip was to gain an awareness and appreciation for the atoll's ecosystem and to convey this to their students and to the general public.

The rapid revegetation of Sand Island is continuing. Forty-three Tournefortia bushes and seedlings were reported on the island in May.

No visits by FWS staff were made to Rose Atoll in 1985.

RE.

### B. CLIMATIC CONDITIONS

The nearest weather station to Rose Atoll is located 180 miles to the west at Pago Pago on Tutuila Island, American Samoa. There is a distinct difference between the topography of Rose and Tutuila Islands, so there is little value in summarizing weather data for Tutuila. The climatic conditions at Rose can be summarized as warm and humid. Prevailing tradewinds are from the ESE.



Rose Atoll NWR. Rose Island is on the left and Sand Island is in the foreground. A single channel (right foreground) leads into the lagoon. Refuge files photo.

RF.

#### D. PLANNING

##### 2. Management Plan

Rose Atoll NWR is administered by the FWS under a Cooperative Agreement with the American Samoa Government developed at the time the refuge was established in 1974. The agreement provides for management of the refuge through periodic aerial surveys and the deputization of Samoan officials to enforce refuge regulations. Budget constraints and changing needs have necessitated a revision of the Agreement which was initiated in 1981. The revision is currently on "hold" pending the completion of an assessment of the giant clam population within the Rose Atoll lagoon.

Early in 1980, the Office of Marine Resources (OMR), American Samoa Government, requested the FWS to study the feasibility of allowing Samoan fishermen to harvest giant clams (Tridacna maxima) from the lagoon and reefs of Rose Atoll on a strictly regulated basis. In December of that year, the OMR submitted a draft management plan for the clam fishery which included minimum size limits, a closed area,

and observer coverage for all fishing trips. The proposal repeatedly emphasized the need for additional data. The FWS has conducted six field trips to Rose since 1980. During each of these trips, stock assessment and ecological data were collected for the Tridacna population and considerable data now exist relative to growth rate, size at maturity, age, mortality, size frequency, population density and distribution.



RE

The giant clam, Tridacna maxima, is known by the Samoans as "faisua". This specimen measures about 8 inches, which is average size for a mature individual. GL

In 1985, funds were budgeted to compile and analyze the data and to recommend a strategy for managing the clam resource. This report would form the basis for a decision on whether to open the refuge to clam fishing. Dr. Richard Radtke, University of Hawaii, was contracted to conduct the analysis and write the report. He conducted clam research during two of the FWS field trips to Rose Atoll and is very familiar with the resource and existing data. His report will be completed in 1986.

Late in 1985, a letter was received from the Director, OMR, American Samoa Government, which stated he had re-evaluated the 1980 request and determined that a giant clam harvest was no longer deemed the wisest use of the resource. He requested that no harvest regulations be proposed and that no fishery be allowed. He further stated that Rose Atoll is

the last area in the territory to remain unaffected by fishery impacts and development and, as such, has great cultural, educational, and scientific value which favor preserving the area in its natural state. The FWS shares these sentiments, of course, and is gratified by this realignment of the Samoan government's priorities for the atoll.

The Radtke report is, therefore, no longer required as a basis for managing the Tridacna fishery. It will still have significant value, however, for monitoring the status of the clam population and understanding the lagoon's ecology.



A diver censusing clams. The fish in the foreground are known as "mumu". GL

##### 5. Research and Investigations

Research at Rose Atoll has consisted principally of surveys of terrestrial and marine organisms and habitat during brief visits to the atoll. No FWS personnel visited the refuge during 1985, but two visits were made by the OMR. One trip was made May 9-12 to accompany a group of teachers visiting the atoll under Special Use Permit ROS-1-85 (described below in Section H.3.). The other was made November 20-24 for the purpose of monitoring fishery resources and green sea turtle nesting activity and to collect 21 clam specimens for Dr. Richard Radtke's ongoing study.

## F. HABITAT MANAGEMENT

Rose Atoll, one of the smallest atolls in the world, is composed of a coralline algae reef that encloses a 50-foot deep lagoon. A single channel leads into the lagoon which can be navigated by medium-sized vessels at high tide. The atoll is almost square in shape and is notable for the high density of coralline algae that comprises most of the reef substrate. The atoll is about two miles across diagonally. Two islands are located on the northeast side.

### 3. Forests

Rose Island is dominated by a Pisonia forest on the south side of the island and groves of Tournefortia bushes on the east and north sides of the island. In addition, there is a small grove of coconut palms in the center. The palms were introduced during visits by Samoan officials during the first half of this century. The Tournefortia forest has increased in size from a few plants in the early 1970's to the point where most of the northern and eastern part of the island is covered by this bush. It provides nesting habitat for red-footed boobies and frigatebirds.

In April, 1983, six Tournefortia bushes up to five feet tall and two seedlings were observed on Sand Island. There are no historical records of vegetation on this island and none was documented during the previous FWS field trips. In May, 1985, a group of science teachers visited Sand Island and reported the presence of 47 Tournefortia bushes of various sizes. It thus appears that Sand Island will soon be well vegetated.

### 6. Other Habitats

The principal habitat at Rose Atoll is the marine habitat. The reef, which is dominated by coralline algae, forms an approximate square with a single opening to the sea. The outside of the reef descends to great depths and is composed of an extremely diverse coral complex. The inner edge of the reef crest slopes gradually to a rubble-dominated shelf that contains numerous patch reefs composed of coralline algae, coral, and a diversity of other sessile invertebrates including the giant clam, Tridacna maxima. The rubble shelf slopes abruptly to about 50 feet and forms the bottom of a one-mile wide lagoon. The bottom of the lagoon is principally composed of rubble, sand, and small coral patches. Occasional patch reefs project nearly to the surface. A high diversity of fishes and invertebrates is present within the lagoon. The diversity is even greater outside the atoll.

## 10. Pest Control

All visitors to the atoll report the presence of Polynesian rats on Rose Island. No attempts to control the animal have been instituted, although it is possible that the presence of the rats may be correlated with the absence of subterranean nesting birds. Rats at Rose have often been observed to prey on the eggs of ground nesting birds like the sooty tern.

## G. WILDLIFE

### 1. Wildlife Diversity

Wildlife resources at the atoll include nesting and resident seabirds, nesting endangered and threatened sea turtles, rats, and a low diversity of terrestrial invertebrates (coconut crabs, hermit crabs, and insects). Diversity varies during the year because of the seasonal nature of the use of the atoll by nesting seabirds.

Coconut crabs, Birgus latro, were unknown at Rose Island until their presence was documented during the October 1982 field trip. During the 1984 trips, juveniles were commonly observed around the campsite at night, and one individual weighing an estimated one-quarter pound was found.



A young coconut crab, Birgus latro. RJS

## 2. Endangered and/or Threatened Species

Rose Atoll supports populations of resident, and possibly nesting, endangered hawksbill turtles and resident and nesting populations of threatened green sea turtles. Considerable nesting activity was observed during the October 21-25, 1984 visit. It was estimated that 33 green sea turtles came ashore at Rose Island during four nights of observation.

No green sea turtle nesting activity was observed by the OMR staff during either their May 9-12 or November 20-24 visits to Rose Atoll. Abundant indications of recent nesting, however, were found during the November trip. A total of 126 nests/pits and 48 plainly visible tracks were noted around the perimeter of Rose Island and 118 nests/pits and 7 tracks were counted at Sand Island.

## 5. Shorebirds, Gulls, Terns and Allied Species

Eleven species of sea birds comprise the most prominent group of wildlife within the refuge. The species nesting at Rose Island in approximate order of abundance are: sooty, tern, black noddy, white tern, brown noddy, red-footed booby, masked booby, brown booby, great frigatebird, red-tailed tropicbird, lesser frigatebird, and white-tailed tropicbird.



The bristle-thighed curlew. RJS

Common shorebirds at Rose Atoll are the golden plover, ruddy turnstone, wandering tattler, bristle-thighed curlew, reef heron, and sanderling.

#### 11. Fisheries Resources

Fishery resources within the refuge include a wide variety of reef fishes, resident and migratory pelagic fishes, lobsters, and tridacnid clams. Some commercial fishing is conducted for bottomfishes (snappers, groupers, and jacks) along the outer reef slope at depths of 20-200 fathoms just outside the Refuge boundary. The long distance to the inhabited islands (180 miles to Tutuila and 80 miles to Ofu), however, limits the effort to less than a half dozen boat trips per year.

### H. PUBLIC USE

#### 1. General

Because of the small size of the refuge, the presence of threatened green sea turtles and endangered hawksbill turtles, and the susceptibility of the island environment to noxious species introductions, public access is restricted to all but those conducting activities that will benefit the resources or provide outstanding educational opportunities.

#### 3. Outdoor Classrooms - Teachers

Both the American Samoa Government and the FWS feel that the natural resources of Rose Atoll have great educational value to the territory. Efforts to take advantage of this value are encouraged. To this end, a Special Use Permit (ROS-1-85) was issued to Mr. Rick Davis, Science Specialist, Department of Education, American Samoa Government, which authorized six local high school science instructors and Mr. Davis to enter the refuge for about three days under the supervision of the Office of Marine Resources. The purpose of the trip was to provide the teachers with an awareness of the environmental importance of Rose Atoll to the Territory of American Samoa and to give them the experience of being on and studying the atoll so they could convey the experience and importance to their students and to the Samoan public. The teachers took photographs, tagged and measured clams, conducted reef transects for comparison with transects on Tutuila Island, collected sand and plankton for comparison with Tutuila samples, inventoried plants, made seabird and turtle observations, and kept journals. Upon their return to Honolulu, each teacher was required to

present at least four lectures and slideshows to school classes and to the public and write a narrative of their impressions and observations. The trip was videotaped for presentation on the local TV station and featured in the local newspaper. The entire effort was very successful and plans were immediately begun to conduct a similar trip in 1986.

KILAUEA POINT NWR  
Kilauea, Kauai, Hawaii

ANNUAL NARRATIVE REPORT  
Calendar Year 1985

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

INTRODUCTION

Formerly a U.S. Coast Guard Light Station, Kilauea Point was designated a National Wildlife Refuge in 1985 to protect the area resident seabirds. Situated on a 32 acre peninsula 200 feet above the sea, the refuge juts into the Pacific Ocean at the northernmost tip of the Island of Kauai.

In addition to providing one of the best opportunities to observe Central Pacific wildlife, Kilauea Point offers spectacular coastal scenery and the historic Kilauea Lighthouse built in 1913.

Wildlife observed seasonally include the following bird species: Laysan albatross, wedge-tailed shearwater, red-footed booby, white-tailed tropicbird, red-tailed tropicbird, brown booby, and great frigatebird.

Often seen in the surrounding waters are Pacific green sea turtles, humpback whales, and spinner dolphins.

The public areas of the refuge have been landscaped with native coastal plant species affording the visitor the opportunity to learn about these species--an effort combining conservation and aesthetics.

A Visitor Center located next to the lighthouse is staffed by volunteer docents who are available to answer questions about the area and to conduct informal tours focusing on current wildlife activity.

A sales outlet run by the non-profit Kilauea Point Natural History Association offers for sale an excellent selection of books and publications, USGS topographical maps, and other items relative to Hawaii's unique natural history.

Kilauea Point is open to the public Sunday through Friday, from 12:00 noon to 4:00 p.m.

KILAUEA POINT NATIONAL WILDLIFE REFUGE

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K. FEEDBACK

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A. HIGHLIGHTS

Kilauea Point became the 425th National Wildlife Refuge after transfer of the property from the U.S. Coast Guard to the U.S. Fish and Wildlife Service effective February 15, 1985 (Section C.1).

Refuge parking lots and entryway overlook were paved on November 21. Subbase work was completed in increments prior to paving (Section E.1).

Four Laysan albatross nests were reported during December. The possibility now exists that a small colony may eventually form within the protection of the refuge (Section G.5).

Kilauea Point Natural History Association, the refuge-formed cooperating association, reported gross sales of \$27,359.45 during 1985 (Section H.18).

Association funds expended during 1985 totaled \$1,722.34. A number of items were purchased to assist in education and interpretation. These items included binoculars, 2 spotting scopes, an inventory-recording cash register, 2 children's wildlife publications, and several public lecture programs (Section H.18).



Kilauea Point National Wildlife Refuge became the 425th Refuge in the United States on February 15, 1985. DM

B. CLIMATIC CONDITIONS

On January 7, strong winds did minor damage to refuge native plantings. A heavy rain storm on February 14 caused minor flooding and erosion damage to the edge of the roadways and at the overlook area.

Normal weather continued through the year with lower than normal rainfall conditions prevailing the last quarter.

Weather data for 1985 is as follows:

|       | Rain<br>(inches) | Temperature |       | Winds (MPH) |
|-------|------------------|-------------|-------|-------------|
|       |                  | High        | Low   |             |
| Jan.  | 11.96            | 78.2        | 63.2  | 10.7        |
| Feb.  | 12.97            | 78.2        | 67.4  | 13.3        |
| Mar.  | 5.10             | 77.5        | 69.5  | 21.7        |
| Apr.  | 3.39             | 78.2        | 67.5  | 15.1        |
| May   | 2.86             | 79.9        | 69.7  | 16.5        |
| Jun.  | 2.04             | 83.3        | 72.0  | 13.4        |
| Jul.  | 4.32             | 84.9        | 74.8  | 15.8        |
| Aug.  | 4.52             | 85.0        | 74.8  | 15.1        |
| Sep.  | 3.26             | 84.6        | 73.2  | 12.8        |
| Oct.  | 7.61             | 82.1        | 72.6  | 13.4        |
| Nov.  | 4.45             | 80.2        | 66.7  | 11.5        |
| Dec.  | .84              | 79.0        | 65.0  | 12.8        |
|       | <hr/>            | <hr/>       | <hr/> |             |
| TOTAL | 63.32            | AVE. 80.9   | 69.7  |             |

C. LAND ACQUISITION1. Fee Title

Formal refuge status of the Kilauea Point property took place on February 15, 1985. Kilauea Point National Wildlife Refuge became the 425th National Wildlife Refuge in the United States.

The U.S. Fish and Wildlife Service and NOAA agreed to the terms for the continued operation of a RAMOS automated weather station on refuge property. NOAA will provide interpretive accompaniments to the data-gathering structure.

### 3. Other

Community members and several environmental groups have sought support for the acquisition of approximately 100 acres of the adjacent Crater Hill property. State Representative Peter Apo, Waianae/North Kauai, and James Aki, State Senator in the same district, introduced resolutions in the respective legislative bodies to request that the Department of Land and Natural Resources investigate the possible acquisition of the area. The Service informally agreed to manage the area should the State ultimately purchase it.

The Hawaii Chapter of the Nature Conservancy has also been communicating with the land owners.

The 100 acre parcel is an extension of the Kilauea Point environment and contains the bulk of the red-footed booby colony which moved off of the refuge after their roost was destroyed by Hurricane Iwa in 1982.

Supervisory Realty Specialist, Dick Moore, reviewed Kilauea Point realty facilities on April 18.

In May, Bill Meck conducted an appraisal of the Kilauea Point property and residential units.

The Kauai County Council appropriated \$25,000 for repairs to the Kilauea Point access road on August 28. The Kauai County Council Intergovernmental Relations Committee visited the Kilauea Point facility and met with refuge staff to discuss road safety. A bill was later passed to lower the speed limit from 25 miles per hour to 15 miles per hour.

## D. PLANNING

### 2. Management Plan .

In February, Dick Kuehner, Regional I&R Specialist met with Honolulu and Kilauea staff to review and update the Public Use Plan.

### 4. Compliance with Environmental and Cultural Mandates

Assisted by volunteers, refuge staff have made a concerted attempt to locate, copy, and consolidate information pertinent to the Kilauea Lighthouse, a National Register Historic property.

On January 17, Moriarty reviewed all Honolulu U.S. Coast Guard files because the staff was concerned that some documents would be destroyed and/or difficult to obtain after transfer. Over 15 photographs and a number of reports were obtained through those efforts.

Former Hawaii Assistant Refuge Manager Rick Coleman was able to assist the project by screening the lighthouse keeper's log held in the National Archives in Washington, D.C. He selected a number of important log entries and photographs depicting the early history of the Lighthouse, all of which will be reproduced.

We were also able to obtain several early photographs from the U.S. Coast Guard Archives in Washington, D.C.

Forty photographs of the Kilauea Lighthouse, taken by deceased Kauai photographer Harvey Tam to commemorate the 50th anniversary of the Lighthouse, were donated for our use by his sister Priscilla Leong.

Several former Lighthouse keepers and area residents were located and interviewed for their recollection of Kilauea Point. They included: Stanley Huntington of Miami, Florida; Fred Robins of Ewa Beach, Oahu; Claude Platt of Honolulu; and David Kauhunaele. Ruby Scott, a former Kauai schoolteacher who attended the opening of the lighthouse in 1913 when she was seven years old, will be interviewed.

Plans are being formulated for a May 1988 function to celebrate the 75th anniversary of the Kilauea Lighthouse. The plans call for a short publication highlighting the history of the Lighthouse.

## 5. Research and Investigation

During the year, the following research activities were conducted:

G. Causey Whitow, University of Hawaii: Water loss in pipped eggs of the red-footed booby.

D. Moriarty and R. Bottomley: Laysan albatross nesting attempts, Kauai, Hawaii.

D. Moriarty and R. Bottomley: Wedge-tailed shearwater nesting success, Kilauea Point, Kauai.

## E. ADMINISTRATION

### 1. Personnel

The staff throughout the year included:

.. Dan Moriarty, GS-9, PFT Park Ranger  
Noreen Bautista, GS-4, PPT Clerk-typist  
Richard Bottomley, WG-5, TFT Maintenance Worker

Special Achievement Awards were presented to staffers Richard Bottomley and Noreen Bautista. Moriarty received a quality step increase.

To accommodate the increased work load, Noreen Bautista's hours were increased from 20 to 32 hours per week.

On January 10, Pacific Islands Administrator Al Marmelstein reviewed operations at Kilauea Point. Hanalei and Huleia NWR's and Crater Hill were also inspected by Mr. Marmelstein.

Regional Office Personnel Officials Jack Donahue, Chief, Classification and Position Management, and Jim Sisson, Regional Personnel Officer, met with Kilauea employees to discuss personnel matters and career development, and to review position descriptions.

On April 19, an administrative reorganization was implemented. Refuge Manager (Wetlands) Krakowski's position was reorganized to allow more staff attention to wetlands development. Kilauea NWR Park Ranger was relieved of responsibilities at Hanalei and Huleia NWR's to concentrate on I&R activities at Kilauea Point and other areas as directed by Complex Manager Leinecke.

### 2. Youth Programs

A very successful YCC camp was operated from June 10 to August 2. Kathy Valier, the Student Conservation Association work leader, did an outstanding job organizing the camp. Some problems were encountered with the YCC Environmental Education Program owing to the unsuitability of the North American-oriented "Project Wild" materials to the Hawaiian environment. Kathy worked with refuge staff to develop more suitable materials.

The enrollees included Jeffrey Nakamura (Youth Leader), Kyle Pacheco, Larry Kaneholani, Janel Lum, Viola Lovell, and Kristina Johnson.

Several projects were completed which included the installation of new fencing, weed control, removal of rocks

from the lawn areas, painting speed bumps, and cleaning the exterior of the Visitor Center.



Control burns remove exotic vegetation and provide YCC enrollees with areas to plant native vegetation. DM

#### 4. Volunteer Programs

Kilauea Point NWR relies quite heavily on volunteer assistance. There is a core group of approximately 35 individuals that handle the bulk of the volunteer program. The Visitor Center is staffed entirely by volunteers, with three to four on duty during the hours that the Center is open to the public. The volunteers also assist the refuge cooperating association, the Kilauea Point Natural History Association, in areas such as ordering materials, inventory control, publications, and membership.

In addition to public use activities, the volunteers assist with nursery and landscape projects, secretarial duties, seabird banding, and wildlife monitoring.

There are an additional 30 to 50 individuals who work two to three times a month. Several more work one to two days a week.

Collectively, the group contributed 7,554 hours of service, often utilizing professional skills including editing and

layout, education, illustration, accounting, clerical, and masonry work.

Supervising a large number of unknown talents has presented a challenge to the staff of three; however, some leadership has emerged from within the group.

Volunteers who work with the public are required to complete a 20 hour training course which contains materials related to Kilauea Point, including subjects such as geology, archeological and historical land use, native plant life, native and introduced bird life, wildlife of the surrounding ocean, history of the Lighthouse, understanding of maritime weather, introduction to Kauai's wetlands, and an orientation to the Fish and Wildlife Service.

Since Kauai is a resort area, it has a transient population with a large proportion of "snow birds" (people that winter in Hawaii). Despite some loss of volunteers, we have maintained a group of approximately 120 to 150 persons.

Several social functions are held by the group throughout the year. The most notable is the annual anniversary party held April 20 in which "Hours of Service" awards are presented and the group's accomplishments are reviewed. Regional Director Myshak sent a congratulatory letter which was read by Refuge Complex Manager Leinecke. A supper of roasted chicken, garlic bread, salad, and soft drink was enjoyed at the gathering.

Several problems have emerged with utilizing a group of volunteers this size: The building on Kilauea NWR is not large enough to contain the entire group, and we have a small refuge staff-to-volunteer ratio.

## 6. Safety

Quarterly safety meetings are held by Refuge Safety Coordinator, Richard Bottomley. Topics covered include chain saw work, use of gloves and eye protection, use of safety head covering, and health/sanitation while cleaning up refuges.

Bottomley utilizes a bulletin board in the office to rotate monthly safety posters.

Refuge staff, YCC, and volunteers have been given written emergency procedures to be followed in the event of an accident. These procedures were given a trial when Mrs. Sadora Mitchell suffered a heart attack. She was safely evacuated by ambulance to Wilcox Hospital, Lihue, where she recovered successfully.

Bottomley's safety program can be considered a success as no injuries were reported throughout the year.

#### 7. Technical Assistance

##### U.S. NAVY PACIFIC MISSILE RANGE:

Refuge staff, working with State of Hawaii Wildlife Biologists, assisted the U.S. Navy at Pacific Missile Range, Mana, Kauai, to alleviate the potential of air strikes due to Laysan albatross that are attempting to colonize the area along the main runway.

The hatchlings along the runway were transferred to Sea Life Park where they were allowed to mature in a less hazardous area.

##### NEWELL'S TOWNSEND'S SHEARWATERS:

The exterior lights of the newly built Sheraton Hotel at Princeville was found to attract a large number of fledging endangered Newell's Townsend's shearwater. Moriarty met with the hotel manager and placed an aid station at a convenient spot. A handout was circulated to all employees to apprise them of the situation and to give direction as to where to place the fallen birds.

A total of 154 Newell's Townsend's shearwaters and one dark-rumped petrel were recovered from the Princeville Sheraton Aid Station.

##### OTHER:

Gary Oldenberg, Director of Animal Damage Control for Washington State, visited Kauai refuges on November 6 to observe and discuss predator problems on refuges with State and U.S. Fish and Wildlife Service biologists. He also visited several Kauai problem areas including Lihue Airport (cattle egret airstrikes) and Northrup King Seed Company (seed corn depredation by Hawaiian coot).

The refuge received engineering assistance in August from Bob McVein and Bill Striplin, both from the Regional Office, Division of Engineering. In November, legal assistance was received from Ron Swan, Regional Solicitor.

## F. HABITAT MANAGEMENT

### 1. General

Broadly speaking, most coastal ecosystems in Hawaii were highly disturbed by agricultural activity and by the introduction of numerous plant and animal species. Coastal areas are now far different from their original conditions. Commencing in 1978, the Service began an active program to eliminate alien plants and restore native coastal species. A small nursery was established, and propagules were collected from the few remaining natives.

Over the years, YACC, YCC, and volunteer groups such as the Sierra Club, Boy Scouts, Girl Scouts, and various karate clubs have assisted with clearing and replanting efforts according to a habitat management plan formulated in 1982.

The reestablishment of the native species was designed to achieve several objectives, including the following: To provide the diversity of plant species for nest support and nest construction, to conserve the species for their intrinsic value, to provide an assemblage of native species for educational purposes, and to encourage the community to use native plants for landscaping.



Local Sierra Club volunteers revegetated two critical hillsides with native vegetation. DM

The establishment of large, open grassy areas has proven successful in attracting Laysan albatross onto the refuge. Two Laysan albatross nested in late 1984 and four nests were reported in 1985.

Throughout the year, habitat management resulted in the conversion of over 100,000 square feet of restored habitat. Those efforts included the following: In March, volunteers transplanted 650 Scaevola plants and 150 Pandanus plants. In April, a small contractor was utilized to suppress weedy species stimulated by spring rains. Several Euphorbia and Pandanus plants were planted during the period. In May, the lower parking lot was landscaped with Euphorbia and Sida plantings.

During the summer, the YCC crew provided maintenance for the earlier plantings.

Kauai Girl Scouts planted 25 hala trees in August.

In October and again in November, a Sierra Club volunteer crew of 20 planted two critical areas of the refuge, the hillside below the overlook/entry way and a large barren area across from Quarters #1. Pandanus and Scaevola were used in both plantings.

In December, the staff, assisted by Tern Island Assistant Refuge Manager Larry Martin, removed 20,000 square feet of alien weedy brush and 20 large Casuarina trees from the refuge (see map on following page).

#### 10. Pest Control

##### MAMMALIAN PREDATORS - DOGS, CATS, AND RATS:

Several introduced predators pose a threat to ground nesting seabirds. Most refuge areas have been fenced to exclude dogs, the most destructive of Kauai's mammalian predators. Constant maintenance is required to maintain the integrity of the fence. Cats and rats are trapped on a regular basis.

It has been noted that as feral cats are eliminated, the rat population explodes. The following is a summary of the cats and rats trapped in 1985:

|          | Cats | Rats |
|----------|------|------|
| January  | 5    | 12   |
| February | 0    | 6    |
| March    | 1    | 0    |
| April    | 1    | 11   |

Table continued on following page

## Cats and Rats Trapped in 1985, cont.

|           | Cats  | Rats  |
|-----------|-------|-------|
|           | ----- | ----- |
| May       | 1     | 20    |
| June      | 0     | 11    |
| July      | 2     | 17    |
| August    | 2     | 6     |
| September | 0     | 0     |
| October   | 1     | 20    |
| November  | 0     | 17    |
| December  | 0     | 32    |
|           | ----- | ----- |
| TOTAL     | 13    | 152   |



Rodents require constant trapping throughout the refuge. RB

## MYNA BIRDS:

Under a State of Hawaii permit, myna birds are controlled by shooting during the wedge-tailed shearwater incubation period (June-July). The myna, a Deccan Peninsula introduction, has been known to predate up to 80% of the wedge-tailed shearwater eggs.

The above control measure has suppressed predation to 5-10 eggs from a total of 500-600 active nests.

#### MONGOOSE:

The mongoose, which has proven to be exceptionally destructive to Hawaiian avian wildlife, is not known to be established on Kauai. Unsubstantiated reports continue to suggest the possibility of its existence. Most wildlife professionals consider its introduction inevitable because of the large amount of interisland commerce.

### G. WILDLIFE

#### 5. Shorebirds, Gulls, Terns, and Allied Species

##### BROWN BOOBY:

The brown booby is not known to nest on Kauai. However, up to 40 birds have been observed roosting on Mokuiaeae Island and below Crater Hill. Three to ten birds are observed almost daily in the nearby ocean and on Mokuiaeae Island.

##### GREAT FRIGATEBIRD:

A year-round resident, the great frigatebird does not nest on Kauai. It reaches its greatest numbers during the summer and fall as it engages in a kleptoparasitic relationship with the red-footed booby. During the evenings, from 75-200 birds roost on Mokuiaeae Island and in an ironwood tree below Crater Hill.

Great circling masses of birds are seen in the sky above Kilauea Point, particularly in the fall.

##### LAYSAN ALBATROSS - GENERAL:

Prior to 1975, the Laysan albatross was not known to nest on Kauai. Nesting was confined to the Northwestern Hawaiian Islands, Niihau, and a few scattered Pacific islands where they were extirpated by feather hunters.

Commencing in 1976, Service personnel have continued to monitor Laysan albatross nesting attempts on Kauai.

The sites monitored are summarized as follows:

## LAYSAN ALBATROSS - PACIFIC MISSILE RANGE:

Laysan albatross have attempted to colonize this site since 1975. Potential airstrikes are a concern of the Navy administration. Dogs continue to inflict a high mortality, thus a decrease in the colony population has occurred.

In January, two nests were abandoned. A few adults showed evidence of avian pox around the eyes. On February 13, uncontrolled dogs killed three adults, causing the failure of one nest. By late March, several chicks had died, leaving five chicks. On March 20, three chicks in close proximity to the runway presented a hazard to aircraft. The birds were captured and shipped to Sea Life Park on Oahu. Two of the birds died in early April. The survivor was banded and successfully fledged on July 5. The two chicks remaining at Pacific Missile Range were banded and released. They fledged between July 10 and July 18.

In December, a total of 22 nests were reported at Pacific Missile Range. Most of the birds had been previously banded.

## LAYSAN ALBATROSS - KILAUEA POINT NWR:

Prior to 1983, Laysan albatross were infrequently seen on land at Kilauea Point. In the summer of 1982, a large hillside on the west flank of Kilauea Point was cleared of brush and grass. Tall, intruding trees near the site were topped to keep them out of the flight path of courting albatross.

Between January and April, four to six courting birds utilized the area.

In December 1984, two nests were constructed. One egg was accidentally broken. The other egg hatched; however, the chick was lost a few days later in a torrential storm.

After the nesting season, courtship activity was observed at three acres of the refuge: Albatross Hill, Plover Hill, and Fox Hole Hill.

Refuge efforts were rewarded in December when three nests were reported on Albatross Hill and one nest on Plover Hill.



Laysan albatross on Plover Hill provide visitors with close-up viewing opportunities. DM

#### LAYSAN ALBATROSS - NORTHEAST KAUAI:

No nests were reported in the 1984-85 season. However, a large group of 40 to 50 birds were seen at Kepuhi Point in April. Observation of courting birds were seen at Princeville, Mokolea Point and East Crater Hill. A summary of Northeast Kauai 1985-86 nesting is as follows:

|               |         |
|---------------|---------|
| Kepuhi Point  | 3 Nests |
| Mokolea Point | 0 Nests |
| Crater Hill   | 3 Nests |
| Princeville   | 0 Nests |
| Kakui Point   | 0 Nests |

In all areas, refuge staff attempted to band all albatross encountered. One hundred five birds were banded in 1985.

#### NEWELL'S TOWNSEND'S SHEARWATER:

A threatened species, the Newell's shearwater was once found on all main islands. Today, the Newell's Townsend's shearwater is only known to nest on the steep mountain slopes of Kauai.

These shearwaters were not previously present on the refuge. A cross-fostering experiment conducted between 1978 and 1980 allowed 90 eggs taken from mountain burrows to be cross-fostered under wedge-tailed shearwater adults at the Kilauea Point colony. Of the cross-fostered chicks, 94 percent were reported to have fledged.

During the spring and summer evenings of subsequent years, staff residing at Kilauea Point reported Newell's shearwaters repeatedly calling and circling over the refuge.

In 1983, a banded cross-fostered bird was recovered at Kilauea Point. In 1984, a banded bird was recovered at Kilauea Point and another at Anini Beach, one mile away. These recovered birds were apparently attracted to lights and crashed. The birds were later released alive by refuge personnel.

The first report of a sighting in 1985 was on April 10 when a road kill was seen along the highway in Anahola.

On April 23, vocalizations were heard at Kilauea Point. Vocalizations were documented throughout the summer until mid-August when they ceased.

Despite evenings with intense vocalization, which appeared to involve from four to six birds, no birds were actually observed on the ground.

No band recoveries were made as in previous years.

#### NEWELL'S TOWNSEND'S SHEARWATER - FALL RECOVERY

Each fall, fledgling Newell's shearwater chicks leaving their mountain burrows become disoriented by lights along the coast. These birds strike trees and wires and fall to the ground. A joint U.S. Fish and Wildlife Service and State of Hawaii program, started in 1979, directed the public to bring downed fledglings to "aid stations" conveniently located at several spots on the island. Service and State of Hawaii personnel collected these chicks, weighed and banded them, then released the chicks at protected release sites.

In 1985, a total of 387 Newell's Townsend's shearwaters were recovered on the North Shore throughout the program. An increase, greater than the 1984 total of 188, was attributed to increased development on the north shore of Kauai that resulted in more commercial lighting. This seems to be an important factor in attracting the birds. Staff set up an aid station at the new Sheraton Princeville Hotel when new buildings began attracting a large number of birds.

A total of 1,637 birds were recovered on Kauai in 1985.

## DARK-RUMPED PETREL:

This endangered species is only known to nest on Maui; however, each year in conjunction with the Newell's Townsend's shearwater recovery program, several fledgling dark-rumped petrels are also collected.

In 1985, four birds were recovered from Hanalei aid stations.

## RED-FOOTED BOOBY:

A colony of 500-700 breeding pairs are located east of Kilauea Point. Twenty-five years ago, the colony was on Kilauea Point. However, it has moved eastward off the refuge. The last move occurred in 1982 after Hurricane Iwa destroyed the trees which supported the colony. Today only 10 percent of the colony remains on refuge property.

In 1985, nest construction commenced on February 5. Egg laying began in March. Hatching took place in late April and early May.

Dr. Causey Whittow of the University of Hawaii conducted studies of weights of pipping red-footed boobys.

After sighting the first fledgling on July 12, a census was conducted between July 24 and 31. The census revealed a total of 254 chicks; these chicks ranged from downy to having full flight feathers. By October, most fledglings had left the colony.

Four injured, immature birds were brought to the refuge for treatment. Three recovered, and one died.

## RED-TAILED TROPICBIRD:

Commencing in May, red-tailed tropicbirds carried on courtship displays at the northeast tip of Kilauea Point. From five to ten birds were involved. A second group of ten to twenty courting birds were seen adjacent to the booby colony.

Despite the normal amount of courtship, no nests were found in 1985. It appears that some may have been located at the extreme edge of the cliffs and were inaccessible.

## PACIFIC GOLDEN PLOVER:

From ten to twenty plovers winter on the refuge after returning from their breeding grounds in the Arctic in early

August. These birds depart for the breeding grounds in late April.

#### RUDDY TURNSTONE:

A flock of five to twelve birds utilized lawn areas of the refuge during the winter months.

#### WEDGE-TAILED SHEARWATER:

A colony of 500-600 breeding pairs were located around the edge of the Kilauea Point Peninsula. Management efforts, including fencing, trapping and shooting, have been utilized to reduce predation due to dogs, cats, rats, myna birds and barn owls.

In 1985, the first birds returning to the colony were observed on March 15. Every other Wednesday evening, staff and volunteers walked through the colony checking for bands. A total of 1,835 birds were examined and 211 bands recorded.

Egg laying took place in mid-June and hatching occurred in late July and early August.

Between November 4 and November 7, the staff, assisted by volunteers, banded 504 wedge-tailed shearwaters. Fledging took place in late November and in the first week of December.

Predation was reduced to a few apparent owl and cat kills. Myna birds predated five to ten eggs.

#### WHITE-TAILED TROPICBIRD:

In late spring, four to ten white-tailed tropicbirds were seen on a regular basis along the Kilauea Point cliff face.

One nest was located in a gully below Plover Hill.

#### 9. Marine Mammals

##### HAWAIIAN MONK SEAL:

No Hawaiian monk seals were seen in 1985.

##### HUMPBACK WHALE:

Humpback whales were observed at sea from Kilauea Point during the months of January, February, March, April and

early May after an absence of sightings during the winter and fall months.

The interpreter/volunteers recorded sightings, frequency, and activity of whales seen from the Lighthouse on a National Marine Fisheries Service shore spotters log.

#### SPINNER DOLPHIN:

From 60 to 120 spinner dolphins are seen in the ocean off Kilauea Point throughout the year.

Observations are more frequent during the summer months in the bay to the west of the Point; however, this may be a result of sea surface conditions rather than an indication of their actual presence.

#### 10. Other Resident Wildlife

Pacific green sea turtles are often seen throughout the year feeding in waters off Kilauea Point.

### H. PUBLIC USE

#### 1. General

Kilauea Point National Wildlife Refuge is considered the main public contact point for the 13-unit refuge of the Hawaiian and Pacific Islands National Wildlife Refuge Complex. The other 12 refuges have minimal or no public use owing to their remoteness or to management concerns that public use will conflict with existing endangered species programs.

Kilauea Point is open daily from 12:00 to 4:00 p.m. Sundays through Fridays and is closed Saturdays.

A pneumatic traffic counter is used to gauge visitation. During closed hours, an overlook outside the entry gate allows visitors to view the refuge and many of the area's seabirds. A modest visitor center staffed by volunteer docents and a cooperating association book shop provides wildlife publications for sale at modest prices. Fifty paved parking spaces, rest rooms, and eight interpretive panels provide additional visitor amenities.

In 1985, the Kauai Lions Club donated four benches and a drinking fountain to aid with visitor comforts.

The attached graph indicates the public use pattern over a five year period. Public visitation is gauged by a pneumatic traffic counter.



Thousands of visitors view seabirds during visitor hours. Here a group observes a nesting wedge-tailed shearwater. RB

## 2. Outdoor Classroom - Students

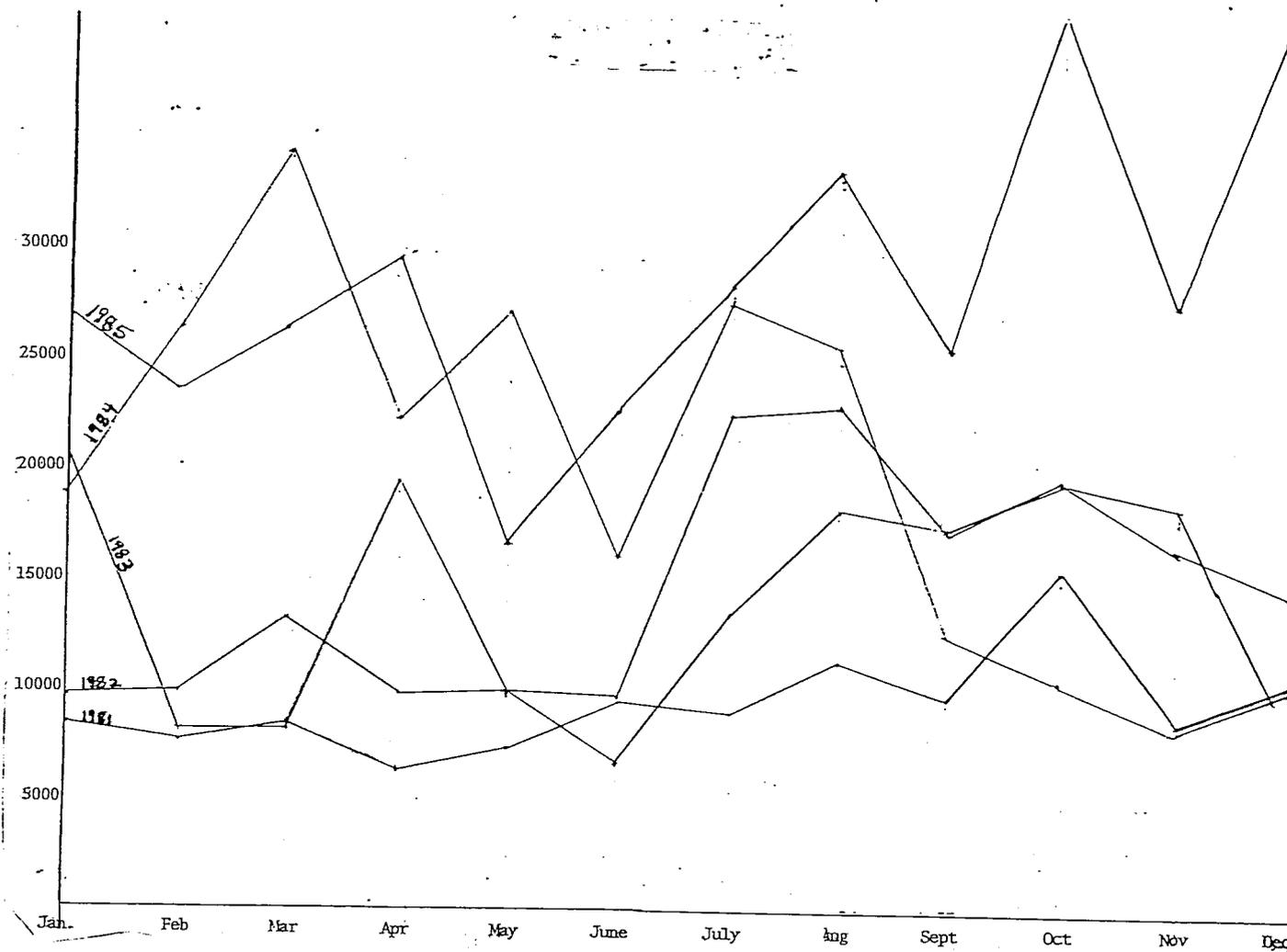
A large number of school groups visited the refuge in 1985. A slide packet and a copy of Hawaii's Birds, a guidebook published by the Hawaii Chapter of the Audubon Society, is sent to each group prior to their visit.

Kilauea Point has become increasingly popular with school groups as a convenient location to study weather, seabirds, history, oceanography, and botany.

Thirty-five school groups (over 2,000 students and teachers) visited the refuge in 1985. A detailed log of schools and number of students visiting is maintained at the headquarters.

## 3. Outdoor Classroom - Teachers

Moriarty continued to meet with teachers on a regular basis to assist in planning the proposed field trips to the



Monthly visitation figures for Kilauea Point NWR, 1981 - 1985.

refuge. Specific visit objectives and pre-visit information packets are given to teachers prior to their visit.

#### 4. Interpretive Foot Trails

Visitors utilize a foot trail which has several interpretive panels. Docents are often stationed along the trail to point out current wildlife activity.

#### 5. Wildlife Observation

All visitors to Kilauea Point are in close proximity to wildlife and should be considered wildlife observers.

#### 17. Law Enforcement

Moriarty attended the annual U.S. Fish and Wildlife Service law enforcement refresher course at Sacramento, California, on April 1 through 5. During the session, he qualified with the service revolver.

On April 10, Kauai Police Chief Calvin Fujita visited the Kilauea Point facility. Chief Fujita offered us full assistance in law enforcement and public safety matters.

In July, Kim Wright, Special Agent, Honolulu, contacted the Honolulu Federal Court to arrange for magistrate services on Kauai, as none have existed for five years.

In September, Moriarty assisted Kauai Police officers in the confiscation of personal property and evidence from a two-man encampment at Huleia National Wildlife Refuge. One of the two men was arrested for growing a controlled substance (marijuana), for distribution, and for possession of a weapon (compound bow) on a refuge. The second man escaped but is being pursued by law enforcement personnel. The case will go to court in 1986.

In November, Moriarty filed a formal complaint with the Federal Aviation Administration as a result of a military C-130 overflying the refuge on November 4.

On November 9, a Mr. Johnson from Seattle, Washington, was ticketed for trespassing.

A large number of problems--including parking, drinking, closed area entry, loud noise, and trespassing--were handled by verbal warning. The large increase in visitation has made this type of action more common.

## 18. Cooperating Associations

Kilauea Point developed its own cooperating association called the Kilauea Point Natural History Association on January 7, 1984. The Association opened a sales outlet on April 16. In the first year of operation, the Association generated \$17,138.94 in gross sales, \$2,135.00 in memberships, and \$2,940.00 in contributions.

In 1985, shop sales increased to \$27,359.45, memberships generated \$1,260.00, and contributions totalled \$40.00.

Brisk sales in the sales outlet often required the staff to become heavily involved in the business activity to provide continuity, since all functions were performed by volunteers. As the Association increases its stock and assets and phases out an existing \$2,000.00 start up loan from the Arizona Memorial Historical Association, it intends to hire a temporary employee to handle its financial affairs.

Three issues of the Association's newsletter, "Kilauea Pointers", were produced and distributed to Association members. Each issue focused on a specific wildlife species found on the refuge and carried information on refuge activities.

Two issues of "Hawaii Nature Focus" were produced and distributed free to all 4th and 5th grade students on the island of Kauai. An additional 2,000 copies were randomly distributed to schools on Oahu and other islands. The first issue featured the whale and the second issue featured the wedge-tailed shearwater.

The association purchased 10 pairs of binoculars and two spotting scopes and made them available free to the public. The new optics have increased the public's interest and enjoyment of the area's wildlife.

The Association sponsored two lecture programs during the period. A whale lecture was held in April and a Summer Sky Astronomy program was held in August. The Association provided transportation for the speakers and refreshments for the public at these events.

A Special Members' Christmas Sale was held in early November. The sale featured a 20% discount on shop merchandise, and several vendors who produced natural history-related arts and crafts were invited. This event was considered a membership benefit. Refreshments were served free to members. The Association earned a 20% commission from the vendors' gross sales. Because of the discount, the Association made less than \$50.00. However, the hundreds of books and art works featuring Hawaiian natural history found their way into the community, thus

reinforcing the Association's goals to expand interest in Hawaii's natural history. This event generated \$3,000.



Kilauea Point Natural History Association annual Christmas Sale. Volunteer Julie Towar assists a customer at this annual "members only" event. DM

The Association is planning a massive membership drive in early 1986. A new membership brochure was produced for distribution.

Two post cards were produced by the Association; one featuring the Kilauea Lighthouse, the other featuring one of our more abundant bird species, the wedge-tailed shearwater.

A new logo developed by volunteer Doris Land was formally adopted by the Association's board.

## E. EQUIPMENT AND FACILITIES

### 1. New Construction

A number of small construction projects were accomplished during the year. Most of these projects were intended to increase visitor safety and alleviate traffic congestion.

## Projects included:

--The lower parking lot was widened to accommodate eight additional parking spaces. A six inch crushed rock subbase was installed and the entire 9,000 square foot lot was paved on November 21.

--A connecting road on the north end of the parking lots was constructed to join the two lots.

--The area at the entry way/overlook was widened and provided with a six inch crushed coral base. The improvements were intended to eliminate a slick/slippery earthen surface which had previously caused both cars and pedestrians to slide after rains wet the surface. These improvements also allowed more turning and parking space. The entire 4,000 square foot area was paved in November. Concrete barrier posts provided by the County of Kauai were also installed at the overlook.

--The 4,000 square foot upper parking lot was excavated and provided with a six inch crushed coral base in April. The lot was paved in November.

--The fencing, which provides predator control and keeps visitors out of hazardous areas, was replaced using YCC labor. The 2 X 4-inch mesh galvanized iron fence was primed and painted prior to installation. Over 6,000 linear feet of fencing was installed.

--A drainage ditch which ran parallel to the entry roadway was filled and compacted to allow for a safe shoulder along the roadway. The drain no longer carried water, as the adjacent property owner changed the grade on his property. Cars often fell into the ditch as they pulled off the road to allow cars to pass on the narrow road.

--A non-functional and unsightly water chlorinator system was removed to allow for better traffic flow.

--A new gate, higher than the previous gate was installed at the entry way to prevent unauthorized trespass and improve the image of the entryway.

--A 1,000 foot length of two inch diameter water line which serves the refuge and ran along the county road was moved ten feet out of the roadway. This allowed safer traffic flow in this narrow hazardous area. Twenty-five percent of the pipe required replacement.



The lower parking lot was widened to accommodate 8 additional parking spaces. Above photo shows lower parking lot before a 6-inch crushed coral subbase was installed and the 9,000 square foot lot was paved. RB



A 6-inch crushed coral subbase was installed in the upper parking lot. The 4,000 square foot lot was paved in November. DM



Refuge water pipe was moved 10 feet uphill from the road's edge to accommodate greater traffic. DM

## 2. Rehabilitation

A U.S. Coast Guard Aids to Navigation maintenance crew chipped and painted the exterior of the historic Lighthouse in December.

The living room and bathroom of Quarters #1 were renovated and painted.

During renovation of Quarters #1, it was discovered that there is a hardwood floor under the former rug and glued fiberboard floor. The fiberboard was removed and the floor sanded. The original 1913 construction is more appealing than the 1959 renovation.

## 6. Computer Systems

Volunteer Burt Lyon donated a Radio Shack TR3 computer for refuge and cooperating association use.

## J. OTHER ITEMS

### 1. Cooperative Program

Refuge staff and volunteers assisted the State of Hawaii with two semi-annual waterbird censuses.

Kewalo Marine Mammal Lab researcher Paul Forestell received refuge assistance in observing and recording activity of whales in the nearby ocean.

### 2. Other Economic Uses

The refuge sustains a sizeable tourist industry. The refuge is mentioned in all tourist guides and in State of Hawaii and Hawaii Visitors Bureau literature. Kilauea Lighthouse and Kilauea Point National Wildlife Refuge have emerged as a major tourist stop. Five tour companies utilizing 14 to 16 passenger vans visit the refuge daily.

The visitors also use the refuge rest rooms since they are the only convenient rest rooms on the North Shore.

Realty brochures often mention proximity to Kilauea Point National Wildlife Refuge.

Sales in the cooperating association provide some income for small businessmen such as book wholesalers, T-shirt manufacturers, and handicraft makers.

### 3. Items of Interest

Hawaii Nature Conservancy officer Kelvin Taketa and several Nature Conservancy members visited the Kilauea Refuge in January to be briefed on current Kilauea activities and on the adjacent Crater Hill property in which the Conservancy previously had an interest in purchasing.

Christine Fraley, a volunteer biologist from the University of Toledo, Ohio, assisted with refuge activities at Kilauea Point from February 19 to 22. Christine worked on an exotic weed control project and spent a day working as an interpreter in the visitor center.

From March 20 to 28, Park Ranger Moriarty assisted Wildlife Biologist Stewart Fefer in seabird census and banding work on Midway. Moriarty also established I&R needs for Midway.

Steven Keller of Yale University, a nationally recognized expert on outdoor recreation, visited Kilauea Point in August. Mr. Keller would like to utilize one of his graduate students to evaluate our public use programs at

Kilauea Point. He plans to write to us with the specifics of his proposal.

On August 21, Lenora Horwitz, Editor of the Kauai Underground Guide, visited Kilauea Point. Ms. Horwitz intends to incorporate Kilauea Point NWR in the next edition of her publication.

On August 17, Moriarty participated in a social historical conference regarding the Hanalei area. The conference was attended by approximately 70 people including State House member Peter Apo, the State Historic Preservation Officer Don Hibbard, and assorted County and State officials.

Jim Hawkins, the Department of Education Environmental Education Coordinator for the State of Hawaii, visited the refuge on October 3 to discuss possible future programs.

A new post card featuring Kilauea Lighthouse at sunrise was produced by Kauai Eye Productions.

Several photographs of the Kilauea Point National Wildlife Refuge have appeared in the recent WTBS Portrait of America series. Several shots of great frigatebirds and red-footed boobys were taken, and the closing shot of the series was of the operational Kilauea beacon casting its light against the historic lighthouse.

A new book, Kauai: A Many Splendored Island (Mutual Publishing of Honolulu, Douglas Peebles and Ron Ronck, 156 pp.) was available in bookstores in late December. The book's dust jacket has a beautiful color aerial photograph of Kilauea Point.

Noted wildlife artist Robert Lynn Nelson produced a serigraph "Beacon of Kilauea" which depicts the Kilauea Peninsula. Three hundred paintings will be produced, and a local art shop will sell them for \$1,500 each.

Wildlife movie producer Wolfgang Bayer photographed segments of a film on the Laysan albatross at Kilauea Point.

Kilauea Point appeared on the cover of "Historic Hawaii", the publication of the largest historic preservation group in the state.

An administrative review of the refuge complex was conducted in February. As part of that review process, a station review of Kilauea Point was held on February 14.

Regional Safety Officer Jim McNulty inspected the refuge facilities including shop, lighthouse, office, and public use facilities.

Contracting and General Services Chief Mike Bowen reviewed small purchasing and imprest activities at Kilauea Point on February 14.

Regional Office Personnel Officers Jack Donahue and Jim Sisson met with Kilauea employees to discuss personnel matters and career development and to review position descriptions.

On January 10, Pacific Islands Administrator Al Marmelstein reviewed operations at Kilauea Point. Hanalei, Crater Hill, and Huleia were also inspected by Mr. Marmelstein.

#### K. FEEDBACK

There seems to be an unusual emphasis on the use of color film to document refuge activities. Despite recent advances in color film technology, the long term instability of the chemicals used to produce the color often renders the details of the slides useless in 20 years. The high temperature and humidity of Hawaii are particularly destructive to color film.

In addition to its preferred archival quality, black and white film better documents detail, and most refuge media activity occurs in the black and white press.

I would suggest the annual narrative format state "good quality color and black and white photographs". It would be nice to be able to compare populations or habitat changes in the year 2086.

HAKALAU FOREST NWR

Island of Hawaii

ANNUAL NARRATIVE REPORT

Calendar Year 1985

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

## HAKALAU FOREST NWR

The Hakalau Forest National Wildlife Refuge was established on October 29, 1985. It thus became the thirteenth refuge within the Refuge Complex. Acquisition for the year totaled eight thousand three hundred and thirteen (8,313) acres.

Two parcels of land were included in the initial establishing acquisition. Both tracts were purchased from the Nature Conservancy of Hawaii (TNC).

Three thousand three hundred nineteen (3,319) acres were purchased directly from TNC, who had title to the land via prior acquisition several years earlier. The Service paid approximately \$330.00 per acre, or \$1,000,000 for the parcel.

The second tract, consisting of four thousand nine hundred ninety four (4,994) acres was acquired from TNC, who acquired the land from W.H. Shipman Estate, Limited, via a simultaneous closing. The Service paid an average of \$564.00 per acre for the land. The land appraisal was as follows: pasture land of 1,328 acres was acquired for \$850.00 per acre, or \$1,130,000. Forested land of 3,665.5 acres was purchased for \$421.00 per acre or \$1,546,000. Total cost for the Shipman Estate land was \$2,676,000.

Total acquisition costs for calendar year 1985 was \$3,676,000.00 for 8,313 acres, or an average of \$442.00 per acre.

The acquisition proposal designates over thirty thousand (30,000) acres to be acquired as funds are appropriated. Scheduled completion date for acquisition is FY88. All acquisition actions were in accordance with the approved recovery plan for endangered Hawaiian forest birds. As the year came to a close, negotiations were underway with Lilioukalani Trust and the Robertson family for acquisition of lands under their ownership.

For general information, the new refuge is located on the windward slopes of Mauna Kea on the island of Hawaii between 4,500 feet and 6,800 elevation. The objectives of the acquisition are: 1) to set aside lands to assure protection and perpetuation of the high elevation Hakalau rain forest, and 2) to provide for the continued existence of habitats essential to the survival of several endangered forest bird species including the akiapolaau, Hawaiian akepa, Hawaiian creeper, Hawaiian hawk, and the o'u, along with the Hawaiian hoary bat and an undetermined number of threatened or endangered plants.

The efforts resulting in the protection of this habitat are an excellent example of a Cooperative Service project. First, the Office of Endangered Species listed 20 species of endangered Hawaiian forest birds without knowing much about them, except that they were very rare.

Next, the Patuxent Wildlife Research Center initiated efforts to systematically survey all the forested habitats in Hawaii. This was accomplished between 1976 and 1982 by staff biologists of the Service's Mauna Loa Field Station.

This was followed by preparation of recovery plans formulated by Research and Endangered Species staffs in Hawaii. These recommendations were placed in the hands of Service decision makers, who evaluated the proposals.

The Hawaii Congressional delegation of Senator Daniel Inouye and Congressman Daniel Akaka recognized the importance of the project and provided necessary appropriations.

Region 1 acquisition staff and Honolulu Endangered Species staff developed and processed all necessary documents and approvals for the acquisition.

The Hawaii Department of Land and Natural Resources and TNC provided invaluable aid in securing the cooperation of adjacent landowners and in facilitating land acquisition.

Finally, as acquisition of the property continues, the refuge begins the long term stewardship role. This refuge has a very unique set of management requirements representing technical and physical challenges found nowhere else in the National Wildlife Refuge system.

The Hakalau Forest refuge is currently administered from the Honolulu office of the Refuge Complex Manager.

