HAWAIIAN AND PACIFIC ISLANDS NATIONAL WILDLIFE REFUGE COMPLEX

BI-ANNUAL NARRATIVE REPORT

Calendar Years 1983 and 1984

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

PERSONNEL (1983)

1. John Andre	Asst. Refuge Manager GS-9 (PFT)	Term 4/17/83	(Tern Is.)
2. Noreen Bautista	Clerk-typist GS-4 (PPT)		(Kauai)
3. Richard Bottomley	Maintenance Worker WG-5 (Temp.)	EOD 4/11/83	(Kauai)
4. Barry Brady	Asst. Refuge Manager GS-9 (PFT)	Term 4/3/83	(Kauai)
5. G. Vernon Byrd	Wildlife Biologist GS-9 (PI)	Temp. Assign.	(Honolulu)
7. Richard Coleman	Asst. Refuge Manager GS-11 (PFT)	Term 9/2/83	(Honolulu)
8. Bruce Eilerts	Biological Tech. GS-5 (Temp.)	EOD 9/6/83	(Honolulu)
10. Steven Fairaizl	Asst. Refuge Manager GS-7 (PFT)		(Tern Is.)
11. Stewart Fefer	Wildlife Biologist GS-11 (PFT)		(Honolulu)
12. Bernard Good	Asst. Refuge Manager GS-7 (PFT)	EOD 7/11/83	(Tern Is.)
* Craig Harrison	Wildlife Biologist GS-11 (PI)	Term 8/6/83	(Honolulu)
13. Shirley Hernandez	Clerk-typist GS-3 (Temp.)		(Honolulu)
14. Darcy Hu	Biological Aid GS-3 (Temp.)	EOD 1/19/83	(Honolulu)
* Steven Kramer	Biological Tech. GS-5 (Temp.)	Term 7/29/83	(Honolulu)
16. Sharon Larson	Refuge Assistant GS-5 (PFT)		(Honolulu)
* William Lemm	Maintenance Worker WG-5 (Temp.)	EOD 2/7/83 Term 5/27/83	(Kauai)
18. Gerald Ludwig	Asst. Refuge Manager GS-11 (PFT)	Term 12/23/83	(Honolulu)
19. Daniel Moriarty	Maintenance Worker WG-6 (PFT)		(Kauai)
20. Nanette Muraoka	Clerk-typist GS-3 (Temp.)		(Honolulu)
21. Maura Naughton	Ecologist GS-7 (CS)		(Honolulu)
22. Mark Rauzon	Refuge Manager GS-7 (PT)	EOD 11/16/83	(Honolulu)
23. Robert Shallenberger	Refuge Manager GM-13 (PFT)		(Honolulu)
* M. Wagner (Stuenkel)	Biological Tech. GS-6 (Temp.)		(Honolulu)
25. David Woodside	Maintenance Worker WG-6 (PFT)		(Honolulu)

Volunteers

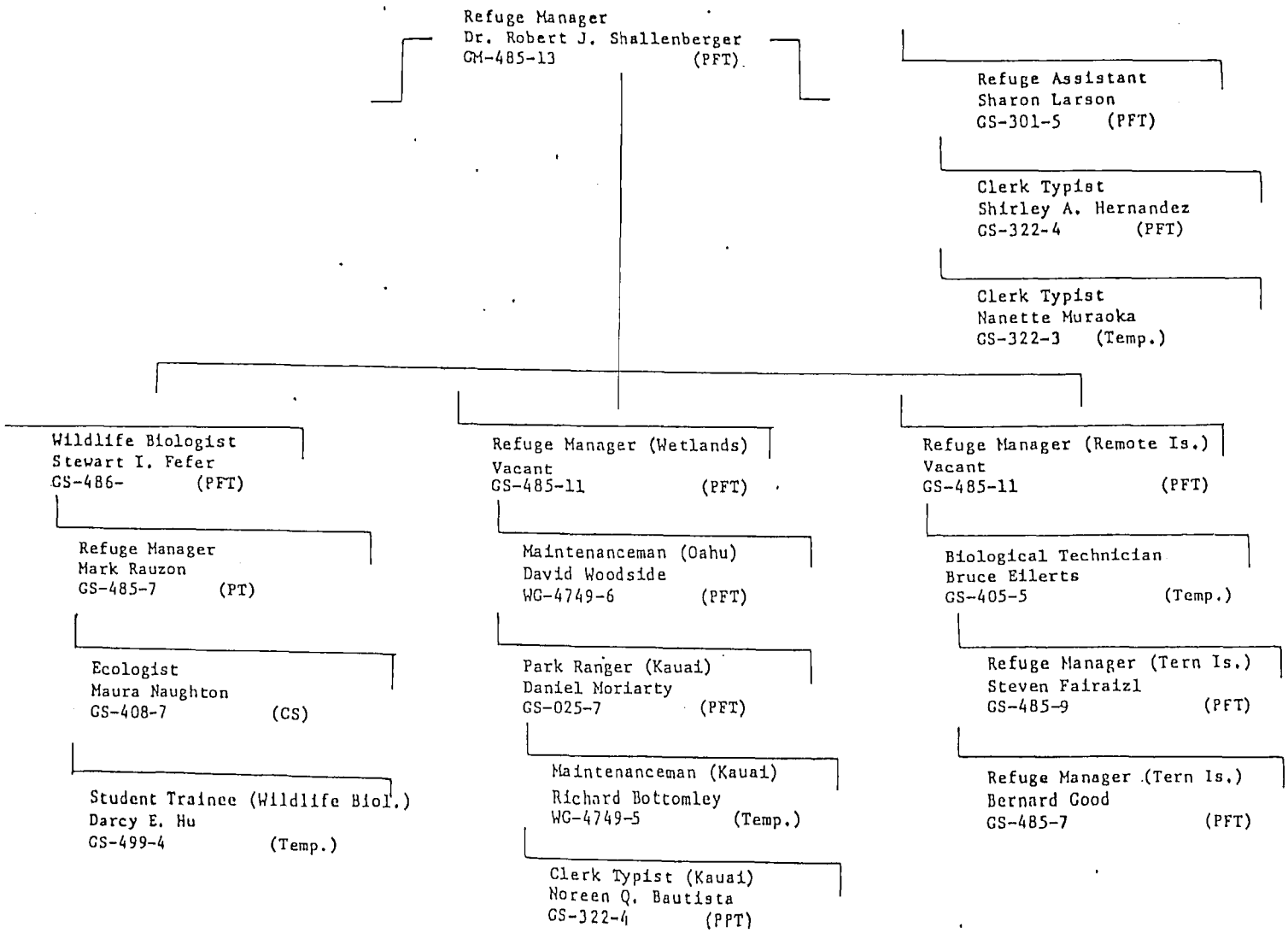
1. Sheila Conant
3. Bruce Eilerts
4. Gale Fairaizl
6. Wayne Gagne
7. Alan Gettman
8. Catherine Good
10. Robin Hanford
27. Scott Jonnston
12. Susan Lautenslager
18. Peter Pyle
11. Robert Pyle
20. Anne Schreiber
21. Ralph Schreiber
23. Renate Sincock
19. Janet Smith
24. Earthwatch Volunteers (30)

YCC

1. Lon Renard - Oahu
2. Enrollees - Oahu (8)
3. Richard Bottomley - KPW
4. Enrollees - KPW (6)

*Not shown in photos on following pages.

Organizational Chart as of 12-31-83
Refuges and Wildlife Resources



PERSONNEL (1984)

2. Noreen Bautista	Clerk-typist GS-4 (PPT)		(Kauai)
3. Richard Bottomley	Maintenance Worker WG-5 (Temp.)		(Kauai)
5. G. Vernon Byrd	Wildlife Biologist GS-9 (PI)	Temp. Assign.	(Honolulu)
6. Katherine Castelo	Refuge Assistant GS-6 (PFT)	EOD 6/10/84	(Honolulu)
8. Bruce Eilerts	Biological Tech. GS-5 (Temp.)		(Honolulu)
9. Gale Fairaizl	Biological Aide GS-3 (Temp.)	EOD 1/3/84	(Tern Is.)
10. Steven Fairaizl	Asst. Refuge Manager GS-9 (PFT)		(Tern Is.)
11. Stewart Fefer	Supervisory Wildlife Biol. GS-12 (PFT)		(Honolulu)
12. Bernard Good	Asst. Refuge Manager GS-7 (PFT)	Term 12/7/84	(Tern Is.)
13. Shirley Hernandez	Clerk-typist GS-4 (PFT)		(Honolulu)
14. Darcy Hu	Student Train. (Wild. Biol.) GS-4 (Temp.)		(Honolulu)
15. James Krakowski	Refuge Manager (Wetlands) GS-11 (PFT)	EOD 1/8/84	(Honolulu)
16. Sharon Larson	Refuge Assistant GS-5 (PFT)	Term 3/16/84	(Honolulu)
17. Faye Lee	Clerk-typist GS-3 (Temp.)	Term 8/10/84	(Honolulu)
* Jerry Leinecke	Complex Refuge Manager GM-13 (PFT)	EOD 8/5/84	(Honolulu)
* Cora Mann	Clerk-typist GS-3 (Temp.)	EOD 8/22/84 Term 10/26/84	(Honolulu)
19. Daniel Moriarty	Park Ranger GS-7 (PFT)		(Kauai)
20. Nanette Muraoka	Clerk-typist GS-3 (Temp.)	Term 5/26/84	(Honolulu)
21. Maura Naughton	Ecologist GS-7 (CS)		(Honolulu)
* Audrey Newman	Biological Aide GS-3 (Temp.)	EOD 6/10/84	(Honolulu)
22. Mark Rauzon	Refuge Manager GS-7 (PT)	Term 5/24/84	(Honolulu)
* Nancy Sautter	Clerk-typist GS-3 (Temp.)	EOD 10/29/84	(Honolulu)
23. Robert Shallenberger	Complex Refuge Mgr. GM-13 (PFT)	Term 8/3/84	(Honolulu)
* M. Wagner (Stuenkel)	Biological Tech. GS-6 (Temp.)	Term 4/3/84	(Honolulu)
24. Richard Wass	Refuge Mgr. (Remote Is.) GS-11 (PFT)	EOD 3/18/84	(Honolulu)
25. David Woodside	Maintenance Worker WG-6 (PFT)		(Honolulu)

Volunteers

1. Sheila Conant
2. Scott Edwards
4. Gale Fairaizl
5. Margaret Fefer
6. Wayne Gagne
8. Catherine Good
9. Rick Guinther
10. Robin Hanford
12. Susan Lautenslager
13. Petra Lenz
14. Ted Mashima
15. Emmy Lou Miller
16. Susan Miller
17. Audrey Newman
18. Peter Pyle
20. Anne Schreiber
21. Ralph Schreiber
22. Russell Shea
23. Renate Sincock
25. Sue White
26. Vera Whyatt
28. Ruth Ittner
29. Jonathan Reed
30. Hawaii Audubon Society's Adopt-a-Refuge-Program (11)
31. Hawaii Kai Boy Scout Pack #225 (15)
32. Kilauea Point Volunteers (44)

YCC

1. Jack Leishman - Oahu
2. Enrollees - Oahu (8)
3. Damien Baptiste - KPW
4. Enrollees - KPW (6)

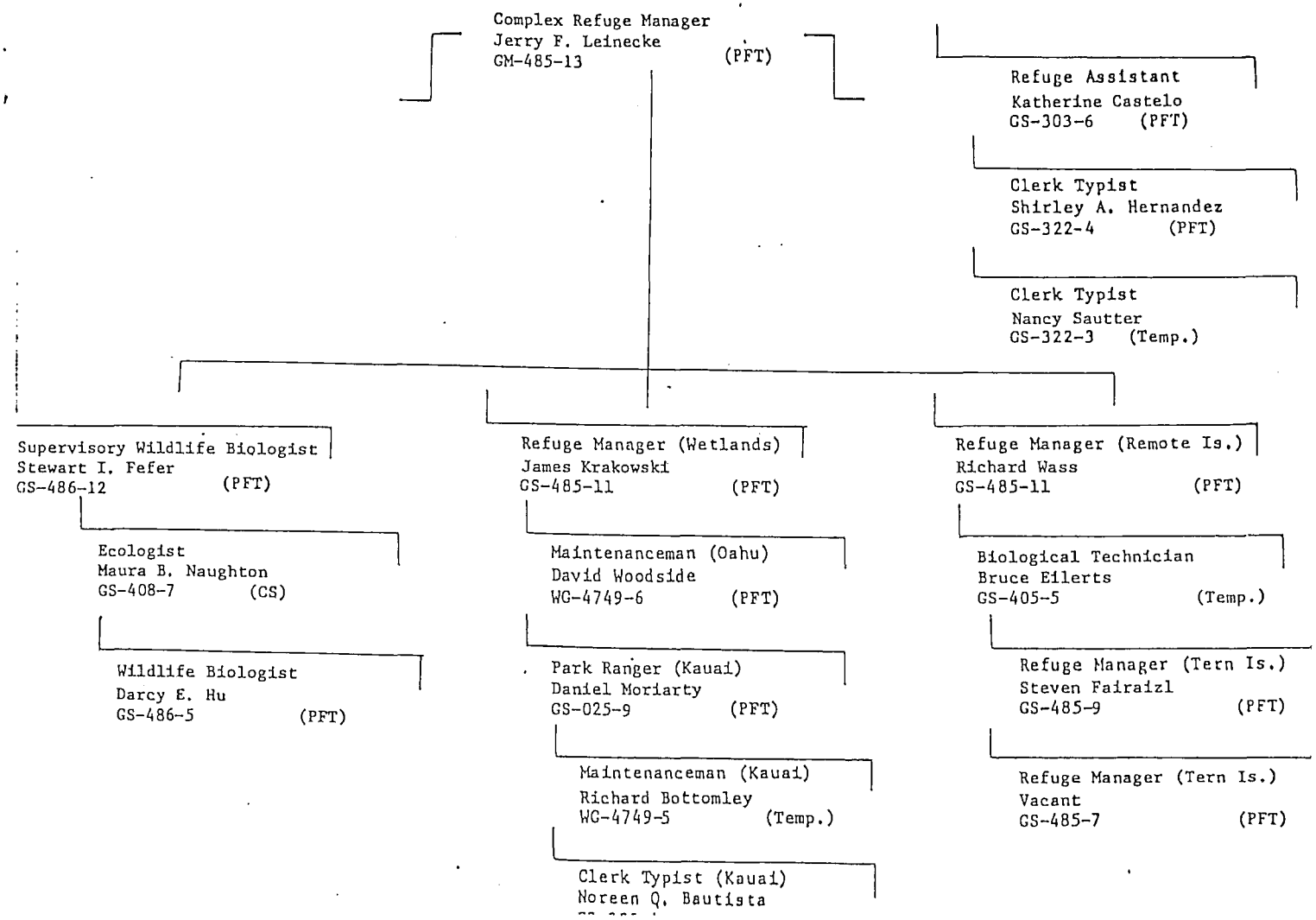
REVIEW AND APPROVALS

Jerry F. Leinecke 12/31/85
Submitted by Date

Pacific Islands Administrator Review 8 Jan 86 Date

Regional Office Review 1/13/86 Date

Organizational Chart as of 12-31-84
Refuges and Wildlife Resources



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20 8 13 17

19 2 4

1 V-28-84 9 10

18

12

KAKAHAIA PARK
DEVELOPED BY THE COUNTY OF MAUI
UNDER PERMIT FROM
U.S. FISH & WILDLIFE SERVICE
DAY USE ONLY - NO CAMPING

7

25

21

V-10-83/84 14

INTRODUCTION

The Hawaiian and Pacific Islands National Wildlife Refuge (NWR) Complex consists of 11 National Wildlife Refuges and one Wildlife Administrative Site. 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 consisting of two units totalling 61 acres, and the James Campbell NWR, established in 1977 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 Kakahaia NWR, located on the island of Molokai, was established in 1976, and consists of 45 acres.

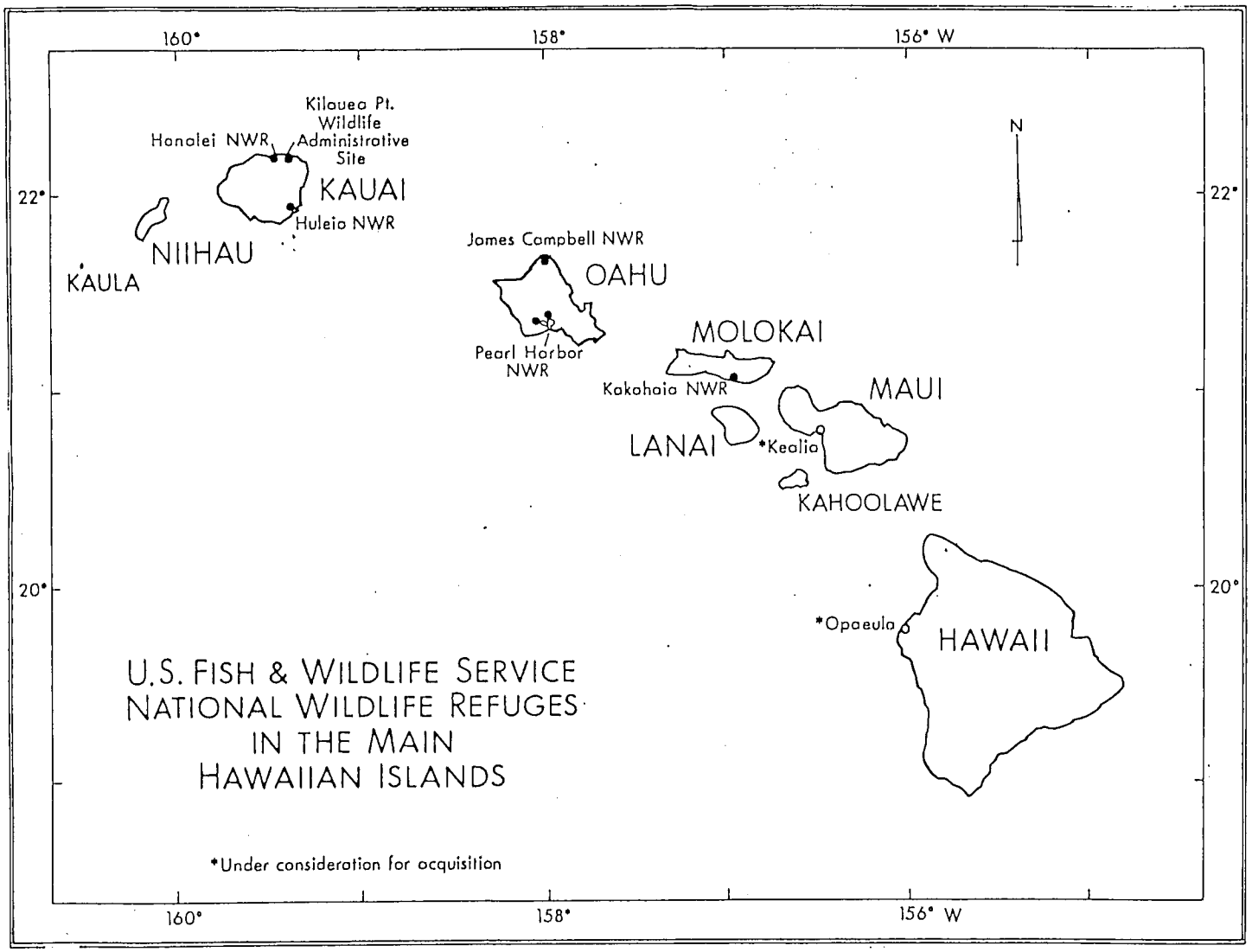
Six remote island refuges in Hawaii and the Central Pacific make up the bulk of the land base/acreage within the complex. These refuges support literally millions of breeding seabirds, unique land birds, and a variety of other marine species, including endangered seals and turtles that inhabit extensive 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. Johnston Atoll NWR was established in 1926 and consists of 691 acres of fast land and 32,000 acres of submerged land. Baker Island NWR, Howland Island NWR, and Jarvis Island NWR 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 32,150 acres of fast land and 36,419 acres of submerged lands. Baker Island, Howland Island, and Jarvis Island NWR's are all 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.

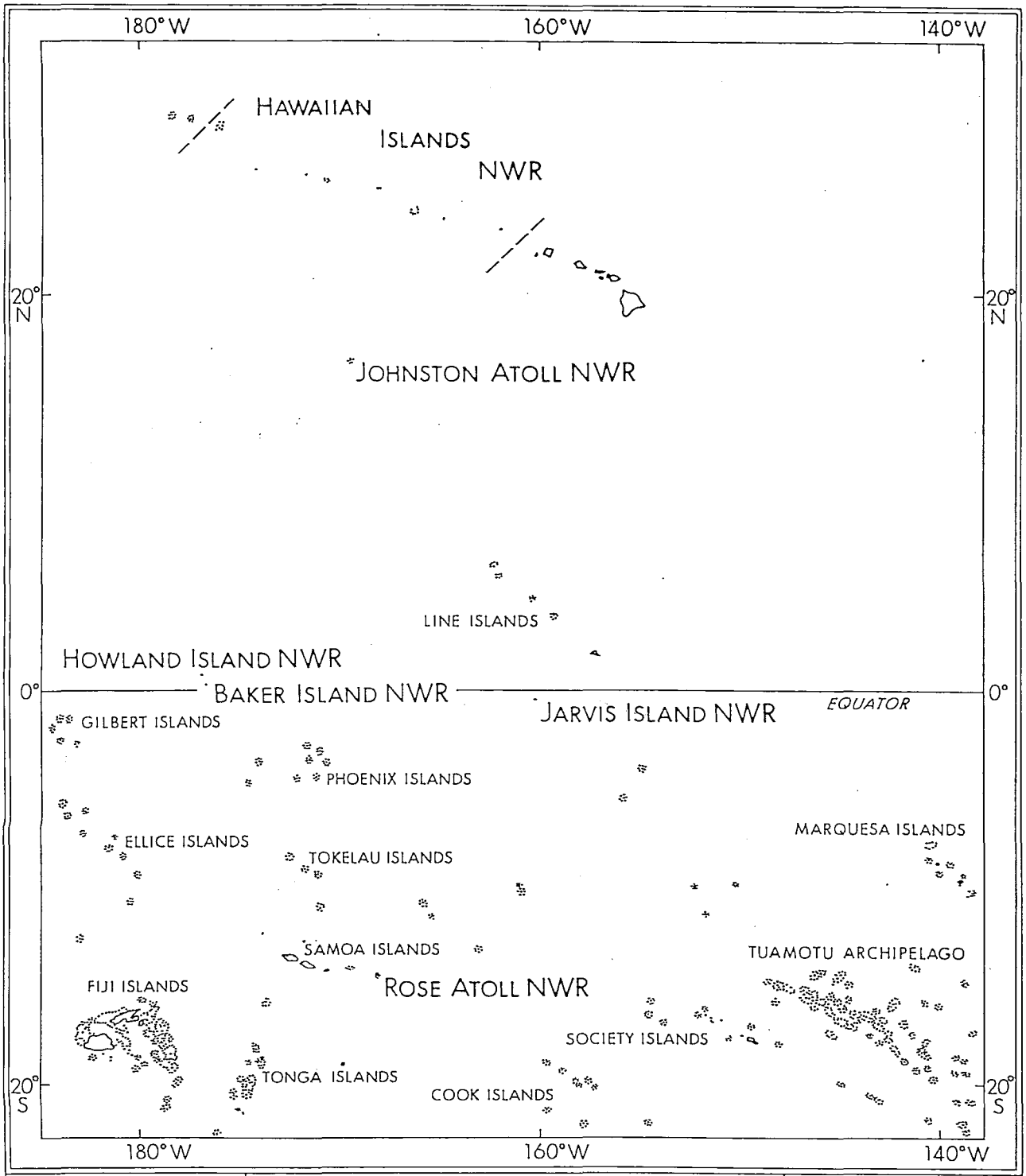
The twelfth unit within the Complex is the Kilauea Point Wildlife Administrative Site on Kauai. This site of 31 acres provides habitat for several resident seabird species and doubles as the Service's primary visitor interpretation site and Kauai Refuge Headquarters. The site is owned by the U.S. Coast Guard. Administrative procedures have been completed to transfer the area from the Coast Guard to the Service, however, the transfer is being handled by the General Services Administration and may not be final for several years. The Service has 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 entire refuge complex is administered from the Honolulu Headquarters located on the 5th floor of the Prince Jonah Kuhio

Kalanianaole Federal Building, 300 Ala Moana Boulevard, in downtown Honolulu.

Prince Jonah Kuhio Kalanianaole Federal Building
RJS


160°
158°
156° W
22°
20°
N
Kilauea Pt. Wildlife Administrative Site
Hanalei NWR
KAUAI
Huleia NWR
NIIHAU
KAULA
James Campbell NWR
OAHU
Pearl Harbor NWR
MOLOKAI
Kakahaia NWR
MAUI
LANAI
*Kealia
KAHOOLAWE
*Opaeula
HAWAII
U.S. FISH & WILDLIFE SERVICE
NATIONAL WILDLIFE REFUGES
IN THE MAIN
HAWAIIAN ISLANDS
*Under consideration for acquisition



Fish and Wildlife Service	HAWAIIAN AND PACIFIC ISLANDS NATIONAL WILDLIFE REFUGE COMPLEX Remote Island Refuges	UNITED STATES DEPARTMENT OF THE INTERIOR

HAWAIIAN/PACIFIC ISLANDS NATIONAL WILDLIFE REFUGE COMPLEX

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A. HIGHLIGHTS

Highlights of 1983 on the wetland refuges in the Complex included major wetland habitat improvement work at Kakahaia, Hanalei and James Campbell NWR's and increased interpretive use of James Campbell NWR. A new 5.5-acre impoundment was constructed at Kakahaia NWR. A windmill/pump was constructed and the 5.5-acre impoundment was filled. At Hanalei NWR, a 48" diameter pipe was placed to provide an improved water delivery system for taro and other wetland habitats on the Refuge. An additional 40 acres of wetland was developed at James Campbell NWR. Teacher-training workshops were held at James Campbell NWR and, subsequently, teacher-conducted outdoor classrooms were initiated. At Kilauea Point Wildlife Administrative Site (WAS), negotiation continued with the Coast Guard and General Services Administration concerning ownership of the facility. The Kilauea Natural History Association was formed (see Kilauea Point WAS).

On the remote island refuges, our major cooperative research effort continued in the Hawaiian Islands NWR where Tripartite studies with the National Marine Fisheries Service, State of Hawaii, and Sea Grant were winding down. Refuge staff participated in the Tripartite Symposium on Research Investigations in the Northwestern Hawaiian Islands, May 25-27, 1983; Assistant Secretary Arnett and Director Jantzen also participated. At the Symposium, Refuge staff presented papers on seabird research and refuge management. Initiation of a master planning process for the Hawaiian Islands NWR was announced at the meeting. Refuge staff coordinated the development of a plan to conduct a baseline biological monitoring program associated with the Johnston Atoll Chemical Agent Disposal System (JACADS) project at Johnston Atoll. Two visits to Jarvis Island NWR revealed that the cat eradication effort conducted during 1982/83 was successful. No cats or sign of cats were noted during the November 19, 1983 visit, and observations suggest that seabird nesting has begun to increase. A mooring buoy was installed at French Frigate Shoals by a fisherman under Special Use Permit from the Refuge. The buoy is for mooring under emergency conditions and should provide added protection to marine resources.

In 1984, the refuge staff participated in an orientation trip for Donald Knowles, Staff Member of the Interior Subcommittee of the Senate Appropriations Committee. During his visit in mid-February, visits were made to James Campbell NWR, Tern Island Field Station, Hanalei NWR, and Kilauea Point WAS. Knowles also visited Kealia Pond, Maui, and several National Park Service sites during his visit. Two albatross nests were found at Kilauea Point WAS.

Several key staff members were replaced during the year, including the Complex Manager, Rob Shallenberger, who transferred to the Departmental Manager's Training Program in Washington, D.C. in July.

B. CLIMATIC CONDITIONS

There were no unusual weather conditions encountered in 1983, but in 1984, a very dry year accounted for severe water use restrictions being set during the summer months. (See individual refuges for more on 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, 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. The following narrative explains progress made at Kealia Pond and Midway Atoll through 1984. Acquisition efforts relating to the transfer of Coast Guard title at Kilauea Point and refuge expansion at Kakahaia NWR and James Campbell NWR are addressed in sections relating to those specific refuges.

1. Fee Title

Kealia Pond

Background. Efforts to acquire Kealia Pond from Alexander and Baldwin, Inc. (A&B) were intitated in 1971 when Director Greenwalt approved the appraised price of $502K for acquiring 747 acres of endangered 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).

1978. The Kuleana concerns were resolved and the original appraisal of $502K was revised to $3.2M for 500 acres. A draft EIS was completed after which opposition arose from the County of Maui, which opted for harbor development, and the Government Accounting Office (GAO), from the State, who objected to Federal purchase. The GAO recommended cessation of Federal acquisition on the argument that the acquisition was not consistent with the Service's criteria relating to the SE program. Acquisition was delayed pending resolution of the SE problems.

1979. Efforts to acquire Kealia Pond continued. Objections of GAO in 1978 to Federal acquisition of Kealia Pond were rebutted by Secretary Joseph and acquisition efforts continued. However, A&B's reappraisal of the 500A at a value of $4.5M exceeded the Service's appraisal price by $1.3M. Therefore, negotiations on a

settling price were delayed. Although the State indicated a desire to purchase the Pond, budget restraints prevented their action from materializing.

1980. Biological data continued to be gathered in 1980, justifying preservation of the area for endangered waterbirds. Numerous State/Federal coordination meetings occurred that resulted in the consummation of a Cooperative Federal/State Habitat Protection Agreement on September 5, 1980. This agreement opened the way for joint acquisition efforts whereby Federal acquisition would commence with the State option to purchase when funds became available. Reappraisals of the Pond area (500A) were undertaken by both the Service and A&B that resulted in a wide discrepancy of land values. The Service's appraised value for 500 acres was $3.3M while A&B's appraisal was $14.5M. The excessive difference in appraisals, $11.2M, resulted in delaying acquisition although $4.5M of Service funds were available.

1981. Kealia Pond acquisition efforts, that were delayed in 1980 as a result of the wide discrepancy in appraised values (A&B $14.5M and FWS $3.3M), were reinitiated. A formal offer to A&B of $4.5M was made in March, 1981, however, no response was received accepting or rejecting the offer. During this same period, a directive was received from RO indicating Secretary Watt had suspended all LWCF acquisition activities, thus resulting in additional delays in Kealia Pond acquisition effort. Later the suspension of acquisition was eased. Coordination with Federal, State, and local government agencies was resumed and compliance with regulatory requirements including CZM, National Historic Preservation Act and NEPA and others were completed. The final EIS was printed and distributed for public comment in August, 1981. With the exception of the County of Maui and GAO, all comments on the EIS were favorable to the alternative "Federal Acquisition with State Option to Purchase." The County continued to emphasize future commercial development including aquaculture with GAO maintaining that State protection was adequate, therefore Federal acquisition was unnecessary.

1982. Although no further progress was made in resolving the appraisal discrepancies, refuge staff remained involved in the evaluation of various acquisition options. Shallenberger visited the site in August with Endangered Species staff from both the Washington Central Office and Portland Regional Office to explore these options. In November, refuge staff prepared an alternative plan to acquire 220 acres (instead of 500) along the north side of the pond. Construction worksheets and a project proposal for this plan were submitted to cover preliminary development and staffing. At year's end, this plan was in the Regional Office for review.

1983. Although no further progress was made in the acquisition effort, Refuge staff remained involved in coordination of the project. The proposed Kealia Pond acquisition project was the subject of some controversy in October when the A&B Executive

Officer, Robert Pfeiffer, publicly announced plans to build a marina at the pond site. This announcement came in response to the County of Maui's request for a 30-year lease on A&B lands used for baitfish culture at Kealia pond. The news media, upon learning of the $4.5M congressional appropriation for Kealia Pond acquisition as a refuge, portrayed the event as a three-way confrontation. This event accelerated the Service's coordination effort relating to refuge acquisition.

1984. Refuge staff conducted a field trip to Kealia Pond on January 11 to review the acquisition proposal and habitat management options with John Van den Akker, a contractor preparing the land Protection Plan for the acquisition. A meeting was held on January 26 with Bob Sasaki (Alexander and Baldwin, Vice-president) and Kelvin Taketa (Field Director, Nature Conservancy) to review the acquisition proposal.

The staff then met with The Nature Conservancy (TNC) staff and County of Maui planning staff to discuss acquisition plans for Kealia Pond. Various aquaculture options and refuge boundary alternatives were discussed. A meeting with the mayor of Maui County was arranged for early March. Regional Office acquisition staff, in town to conduct a class in acquisition procedures, met with PIA and refuge staff to review and plan Kealia Pond acquisition strategy.

TNC took the lead in negotiations for the Kealia tract during the year. Arland Jacobi (AWR-ACQ) appraised the 397-acre Kealia tract for $2.2 million.

3. Other

Midway Atoll

Background. Midway Atoll, under the administration of the United States Navy, has always been recognized as an important atoll for wildlife including migratory birds, monk seals and green sea turtles. In July, 1972, a Cooperative Service/U.S. Navy Agreement was signed for the conservation and management of fish and wildlife on the island. The agreement continues to be in effect.

1978. Discussions commenced with the Midway Navy Command in April concerning the possibility of obtaining refuge status for Sand and Eastern Islands. The need for additional island wildlife protection was brought about as a result of the Navy's plan to reduce operations and the State's proposal to establish a commercial fishing station on the island under a one-year Naval trial permit. A draft cooperative agreement for a NWR overlay was submitted to the Regional Director for approval and meetings were held with the Navy to encourage support. Coordinating efforts continued throughout the year.

1979. The 1978 Midway refuge overlay proposal and agreement with the Navy was delayed in consideration of additional refuge alternatives. Two of the new alternatives involved a revision of the Sikes Act agreement, however, NWR overlay status was deferred until results of the Tripartite Study were in, jurisdiction questions regarding HINWR boundaries were adequately addressed, and a comprehensive resource management plan was developed for the Hawaiian Islands NWR. Data collection was initiated regarding the foregoing concerns.

1980. Coordination continued with the U.S. Navy concerning impacts on wildlife of the military's operational scale-down plan and the State's proposed development of a long-tern fishing supply station on Midway. Data were compiled while developing additional alternatives for the long-range protection of island wildlife.

1981. A draft review of wildlife management options for Midway Atoll was completed in-house, but distribution of the document was withheld pending final decisions by the Navy regarding award of a contract for island operations. In December, 1981, a contract was awarded to Base Services, Inc. A major reduction in onsite military staffing was scheduled for early 1982.

1982. Coordination continued with U.S. Navy officials regarding contractor (Base Services, Inc.) operations on Midway. Wildlife monitoring, disease and other seabird studies are addressed elsewhere in this report. Refuge staff completed a decision document evaluating various wildlife management options, including overlay refuge status, and submitted it for Regional Office review in October.

1983. A review of wildlife management options for Midway Atoll was reviewed and concurred with by Regional Office Personnel. Discussions were held with Navy personnel concerning the overlay refuge proposal.

1984. A wildlife management plan for Midway Atoll was completed. More detailed and intense negotiations for establishment of an overlay refuge took place throughout the year, but no resolution was forthcoming. The proposal was being reviewed by several Navy offices at various levels. Late in the year, the Navy requested an accounting of alleged violations of the migratory bird permits and migratory bird treaty act that have been noted by refuge personnel during official visits during the year. The material was provided to the Navy and at years end the various military internal units responsible for different operations at Midway were discussing what could be done to rectify the shortcomings in their wildlife management efforts. The Navy is attempting to make a strong effort to do wildlife-oriented work and cooperate with the Service in wildlife matters in an effort to show that a National Wildlife Refuge overlay is not necessary and that they can adequately handle the wildlife-related problems on the atoll.

Punahoolopa Wetland

Throughout 1984, refuge staff met with consultants of the Prudential Corporation who plan to develop an area around the Punahoolapa marsh on the island of Oahu near Kahuku. This is an extremely valuable wetland for Hawaii's endangered waterbirds and is identified as a primary area in the Waterbird Recovery Plan. The developer plans to fill a small area of the wetland and develop a golf course and townhouse complex. As mitigation, Prudential agreed to fence, dig a perimeter moat, and open up certain portions of the marsh. The refuge would like to manage this area as part of the James Campbell NWR. The unit lies less than one mile from the Campbell refuge. Discussions were on a positive note as the year ended.

Crater Hill

In 1984, Complex Refuge Manager Leinecke presented testimony in Lihue, Kauai, at a public hearing on a local developer's bid to develop the crest of Crater Hill into an exclusive housing development. The testimony pointed out the importance of the Crater Hill area as a nesting site for a large red-footed booby colony. The past history of Service involvement in starting up a setback area for the development was pointed out, as well as the developer's agreement to honor the setback line and build protective fencing. By the close of the year, the County Commissioner voted unanimously to deny the developer's request for construction variance to build houses on the ridge of Crater Hill.

Refuge Revenue Sharing

In March 1983, Refuge Revenue Sharing Act checks were received from the Regional Office for distribution to the mayors of Maui ($4,654), Oahu ($1,693) and Kauai ($14,720) counties. Shallenberger distributed the checks to executive assistants to the mayors of Kauai and Maui, and Coleman distributed the Oahu check to the City manager.

In March 1984, the Refuge Revenue Sharing Act checks were received and distributed to the same counties as above. Shallenberger and Krakowski distributed checks for $1,867 to Oahu Mayor Eileen Anderson's office, $5,663 to Maui Mayor Hannibal Tavaras' office, and $15,025 to Kauai Mayor Tony Kunimura's office.

D. PLANNING

1. Master Plan - Wetlands

The Wetland Master Plan was submitted to the Regional Office for review in early 1983. Copies were available for review at the Refuge office in Honolulu. No further work was accomplished in 1983. In 1984, the Wetland Plan was reviewed in the Regional Office and returned to the refuge for additional work and inclusion of comments from Regional Office (R.O.). By late 1984, the R.O. advised using a more acceptable format for the plan that was recently approved by them. Expect to conclude revision during 1985.

1.A. Master Plan - Hawaiian Islands NWR

The formal initiation of the Hawaiian Islands NWR Master Plan occurred in May, 1983. Supportive file material was gathered and initial documentation prepared. The first 2 newsletters were distributed and public input received. In January 1984, RO-AWR staff members Paul Camp and Harvey Lee arrived in Hawaii for a one-week session on master planning for the refuge. Master plan objectives were finalized and preliminary alternatives drafted. Preparations for a master plan workshop in March were initiated. Work continued throughout the year at a high level of intensity. In September/October, the public hearings were conducted in Honolulu by Camp, Lee, and refuge staff. The final two newsletters were published during the last one-half of the year. A presentation on the master plan and master planning process was made to the regular meeting of the Western Pacific Regional Fishery Management Council. At year's end, the refuge staff completed the public input and comment review process. All comments were addressed and the responses were forwarded to the Regional Office for formalizing and finalization.

3. Public Participation

The master plan for the Hawaiian Islands NWR allowed the public two opportunities for comments at public hearings, plus formal time for written comments during 1984.

4. Compliance with Environmental Mandates

Biologists Ford and Fefer coordinated with Coast Guard and Navy concerning an oil spill at Midway Island due to grounding of the NIGHTENGALE in 1983. Naughton travelled to Midway with the Coast Guard to ascertain damage.

In February 1984, refuge staff met with Patricia Port (Office of the Secretary, Department of the Interior) to discuss oil spill and other disaster contingency planning.

5. Research and Investigations

Funding became available in October, 1984, to fund a Wetlands Management Research Study to be conducted during 1985.

E. ADMINISTRATION

1. Personnel

Personnel reorganization of the Refuge Complex occurred during 1983 to fulfill the organizational objectives created in 1982. A Park Ranger (Interpretion) position was created at Kilauea Wildlife Administrative Site and the Assistant Refuge Manager position on Kauai was transferred to Honolulu.

FY	C/S	Permanent Full Time	Permanent Part Time	Temporary	Total
1983	1	10	2	7	20
1984	1	11	2	7	21

The following is a breakout of the personnel actions taken during the 1983 calendar year and a short narrative on key actions:

Effective January 1, Darcy Hu began work for Refuges and Wildlife Resources (RWR) on a Cooperative Education program with the University of Hawaii. She worked primarily on Tripartite research until she returned to college in December. Craig Harrison was placed on Leave Without Pay status in late December.

Barry Brady returned from one month's leave in mid-January and soon after began a detail in Honolulu, pending his formal transfer of function to Honolulu from Kauai.

An exemption to the hiring freeze request was prepared for Dan Moriarty so that he could be converted to a Park Ranger (Interpretation) position from his present Maintenance Worker position on Kauai at the Kilauea Point Wildlife Adminsitrative Site. A search was initiated to fill behind him on the maintenance position.

Assistant Manager Gerald Ludwig attended the Basic Refuge Managers Academy in West Virginia.

Brady received formal notice of his transfer of function to be effective February 20. However, this was put in abeyance when he

received word approximately February 15 that he had been tentatively selected for an Assistant Refuge Manager position at Pahranagat NWR in Nevada.

Moriarty was converted to the Park Ranger (Interpretation) position in February.

William Lemm was selected to fill behind Moriarty in a Maintenance Worker position on Kauai (converted from WG-6 to WG-5).

Steve Kramer was selected for the GS-5 (temporary) position to support the Tern Island operation. He was scheduled to be on board April 3.

Barry Brady received formal notice of selection for the Pahranagat NWR Assistant Refuge Manager position. He was scheduled to begin work on April 4.

John Andre was "selected" for the Assistant Refuge Manager position at Deer Flat NWR, pending approval of his exemption request. He was tentatively scheduled to leave Hawaii on April 7 on LWOP and reported to Deer Flat at a later date once the exemption was completed.

Richard Bottomley was selected to be a temporary maintenance worker (WG-5) at Kilauea Point during Moriarty's three month absence to attend F.L.E.T.C. He was also nominated to be the YCC group leader at the Kauai Camp this summer. Lon Renard was nominated to be the group leader for the Oahu YCC camp for the summer.

Bernard Good was selected to fill the GS-7 Assistant Refuge Manager position at Tern Island. His EOD date was July 23, 1983.

William Lemm resigned from his Maintenance Worker position on Kauai. Richard Bottomley filled in on a temporary assignment.

Robert Shallenberger, Stewart Fefer, Maura Naughton, Shirley Hernandez and former RWR employees Craig Harrison, Audrey Newman, Robert Schulmeister and John Andre received Special Achievement Awards for work associated with the Tripartite Studies conducted from 1978 to 1983.

Mark Rauzon, Refuge Manager, was hired as a temporary part time appointment. He will be involved with the Hawaiian Islands Master Planning effort.

Assistant Refuge Manager Jerry Ludwig departed December 22 reporting to a new position in Fishery Research in Homestead, Florida.

Ecologist Maura Naughton returned to work after attending classes at Humboldt State University, California, during the fall of 1983.

Clerk-typist Shirley Hernandez was promoted fom GS-3 to GS-4 at midyear.

Wildlife Biologist Stewart Fefer was promoted from GS-11 to Supervisory Wildlife Biologist, GS-12, in November.

During 1984 the following personnel actions occurred:

Gale Fairaizl was brought on board on a temporary appointment at Tern Island to conduct seabird studies.

Jim Krakowski reported on duty January 8 as the Refuge Manager (Wetlands). His previous station was Brazoria NWR Complex in Texas where he was the primary Assistant Refuge Manager.

Vernon Byrd (Wildlife Biologist) arrived in Hawaii on January 7 on temporary duty to fill in for the vacated Refuge Manager (Remote islands) position.

Dr. Richard Wass was selected to fill the Refuge Manager (Remote Islands) position vacated by Jerry Ludwig. Wass had been employed by the American Samoa government as a fishery biologist in the Office of Marine Resources.

Sharon Larson accepted an appointment in the Office of the Secretary in San Francisco, California, departing Hawaii on March 1, 1984.

Katherine Castelo began in July as Refuge Assistant, GS-6. She transferred from the Service's Environmental Services office in Honolulu.

In August, Jerry F. Leinecke EOD as Refuge Complex Manager. His prior assignment was in the Region 7 Regional Office in Anchorage, Alaska, where he had been seving as Assistant Refuge Supervisor for Alaskan Refuge operations.

Bernard Good transferred in December to Santee NWR in South Carolina from his Assistant Refuge Manager job at Tern Island.

Bruce Eilerts converted from temporary Biological Technician to Permanent Full Time Biological Technician (Remote Islands) in December.

2. Youth Programs

In 1983, six YCC enrollees participated in an eight week (June 27-August 19) 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.

A 6-week non-residential YCC camp was held at Kilauea Point from

July 5 to August 26, 1983. Six enrollees and a work leader hired under the Student Conservation Association completed a number of projects on the site, including reestablishment of native vegetation, painting of refuge buildings, removal of exotic vegetation, fencing and predator trapping.

In 1984, an eight week non-residential YCC camp was held on the islands of Oahu and Kauai for the refuge. The six person Kauai camp was led by Damien Batiste and the eight person Oahu camp was led by Jack Leischman. Two YCC enrollees went to Tern Island for 36 days. Projects for 1984 were similiar to 1983 as this form of labor is used for annual recurring maintenance of wetland refuges.

4. Volunteer Programs

Volunteers for 1983 were used mostly on wildlife inventory and wildlife habitat work on the remote islands. Nearly 7,000 hours of volunteer time was recorded by the 42 individuals involved with the refuge complex. Of the total, 420 hours were volunteered at the Kilauea Point WAS by 18 people.

In June, 1983, Russell Shea, University of Pennsylvania Ph.D. candidate, volunteered to assess disease problems in albatross populations on Midway. He is scheduled to be on Midway conducting his doctoral research on seabirds over the next two years. He will continue photo plots, complete reproductive success studies, and assess disease spread (particularly pox and "droop-wing").

Volunteers Johnathan Reed, Janet Smith, and Ruth Ittner continued to work at Tern Island under the supervision of John Andre throughout the summer.

Peter Pyle, Bruce Eilerts, and Scott Johnston participated in the biological monitoring studies of seabirds during the spring and summer as volunteers on Tern Island, French Frigate Shoals.

In both 1983 and 1984, a large group (50-70) of local volunteers from the Kilauea/Hanalei area were trained to administer a Visitor Contact Site at Kilauea Point. Animal and plant ecology seminars are given once a week and volunteers are required to attend. Volunteers are also helping with the Laysan albatross transplant project. Albatross chicks are being transplanted from Barking Sands, Kauai, to Kilauea Point. The Barking Sand colony of adults and young have been victims of dog predation.

In 1984, the Kilauea Point Natural History Association was organized and the volunteer cadre at Kilauea Point was firmly established. Forty-nine volunteers enrolled for the training sessions required to operate the visitor contact station and interpret local wildlife. Over 4,750 hours of time was donated at Kilauea Point and an additional 2,850 hours were donated by 56 different people to work on other refuges in the complex, mainly

Tern Island and Laysan Island in the Hawaiian Islands NWR.

5. Funding

The following table summarizes funding for Refuges and Wildlife Resources for 1983 and 1984:

FY	Total Staff	1210	1220	1230	1240	1400
83	20	345.0	7.7	3.0	14.0	184.5
84	21	574.4	-	3.0	-	-

FY	1480	1520	1921	1994	2841	Total
83	-	18.758	21.91	3.0	4.53	602.398
84	55.0	20.900	-	7.8	-	661.100

FY83: 1210 base funding remained at the same level as FY82. 1400 funding received a 7K increase from the previous year. The major increase in funding came in the amount of 21.9K in 1921 (migratory birds). YCC funding of 18.75K accounted for the remainder in total dollars increase from 1982. Funds available in FY82 were 536.5K compared to FY83 figure of 602.398K.

FY84: Funding in FY84 was simplified as a program change provided a new fund appropriation system. The 1210 base funding was increased and Endangered Species (1400) funds were abolished. Only 59K total increase in refuge funding for the year. Tripartite work has geared down but total volume of work has dramatically increased, including master planning. Base budget is inadequate to sustain level of operations necessary for a work load of this stations' magnitude.

6. Safety

Safety items of interest that are specific to individual refuges are addressed in later sections of this narrative report. Classes in cardio-pulminary resuscitation (CPR) were attended by RWR staff members in October, 1983.

The safety committee met quarterly during 1983. RWR staff meetings contained safety emphasis each quarter above regular safety briefings.

Krakowski was appointed safety officer for the PIA office in July, 1984. Quarterly meetings started in October, 1984.

7. Technical Assistance

Refuges and Wildlife Resources staff played a substantial technical assistance role during 1983. Technical assistance on off-refuge lands and waters involved military installations, state agencies, and private citizens. Technical assistance to military installations focused on sites with highest priority resource problems/opportunities (Kaneohe, Midway, Johnston). Technical assistance to Ecological Services (Honolulu) was provided upon 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:

Technical Assistance (1983/1984)

Location/Agency(ies)	Project
Kaneohe Marine Corps Air Station (U.S. Marine Corps, Hawaii Dept. Land & Natural Resources)	Completed draft of Wildlife Management Plan for KMACS via reimbursable funding agreement with Marine Corps during 1983 and completed the final plan during 1984. Printing and distribution followed. Conducted wildlife surveys, breeding bird studies, habitat development and predator control projects. Assisted in law enforcement activities resulting in conviction regarding shooting of a migratory bird (see Law Enforcement, page 23). Provided technical assistance concerning wildlife disease, rodent control, and military construction projects in regard to military's effort toward wildlife management. Also aided military efforts to enhance the endangered waterbird habitat at Nuupia Pond on the base.
Midway Atoll (U.S. Navy)	Cooperative wildlife management pursuant to signed coop agreement. Included wildlife surveys, avian disease studies, law enforcement, oil spill monitoring, permit

	monitoring and development of Refuge overlay proposal. Provided technical assistance on rodent control, military construction projects, and seabird diseases to base personnel in regard to cooperative wildlife management agreement. Several proposals on seabird research projects were reviewed in cooperation with Navy personnel. Responses to these projects were drafted and returned to researchers Shea and Mahoney as well as the Navy.
Kaula Island (U.S. Navy, Hawaii DLNR)	Coordinated with Navy to develop seabird studies to assess impacts of bombing. Participated in field effort in 1984 to survey and assess seabird populations and effects of over flights.
Pacific Missile Range, Kauai, U.S. Navy	Coordinated with Navy to advise on increase in populations of Laysan albatross on missile range. Participated in review of effects on albatross and other seabird populations by repeated low level overflights. Transplanted 3 Laysan albatross chicks from missile range to Sea Life Park, Oahu, for hand-rearing experiment. One chick survived and fledged from the Sea Life Park site.
Northwestern Hawaiian Islands (Hawaii DLNR, NMFS, Sea Grant)	Cooperation in implementation of Tripartite Agreement to assess fish and wildlife resources in the NWHI. Provided resource data, logistical support (i.e. Tern Island), field camp management and other assistance. Participated in monthly meetings of Tripartite Coordinating Council and presented results

	at Northwestern Hawaiian Islands Symposium.
Statewide (Hawaii DLNR)	Cooperated in banding and auxiliary marking of Hawaiian waterbirds. Also conducted semiannual waterbird censuses and stilt recruitment count with State biologists. Coordinated on migratory bird permits with State biologists. Attended quarterly meetings with DLNR to open lines of communication, solve problems, and give technical assistance.
Hawaii (DLNR)	RWR staff participated as members of the Hawaiian Waterbird Recovery Team.
Johnston Atoll (Defense Nuclear Agency, U.S. Coast Guard and Johnston Atoll Chemical Agent Disposal System (JACADS)).	RWR staff assisted on-site military personnel in wildlife management, review of military activities and wildlife information. Participated in JACADS evaluation (see Johnston Atoll NWR).
American Samoa (Office of Marine Resources, ASG)	RWR staff cooperated with ASG staff in review of fishery proposals for Rose Atoll NWR, law enforcement, information and education (see Rose Atoll NWR).
Amorient Aquafarm (Amorient Inc., Campbell Estate)	RWR staff assisted in the study and control of migratory birds that were impacting prawn farm production (see Campbell NWR).
Wake Island (USAF)	Bird survey. Preliminary assessment of wildlife management opportunities/ problems. Provided technical assistance on avian/wildlife diseases and military construction to base personnel

	in an effort to establish a baseline wildlife management program.
Kahoolawe (U.S. Navy, Hawaii, DLNR)	Assisted military and State personnel with survey of Kahoolawe for endangered/ threatened seabirds.
Sea Life Park (private)	Coordinated issuance of a migratory bird permit for collection/display of 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.
University of Hawaii	A 5-year plan for the Marine Options Program at the University was evaluated and comments were provided to the director of the program.

Other (Misc.):

Biologist Fefer was designated to serve on the 1984 Regional Response Team for Oil and Hazardous Waste Spills. Several meetings, much correspondence, and limited field work was involved.

In an attempt to provide better technical assistance on seabird diseases to this wide variety of agencies and organizations requesting assistance, Wildlife Biologist Fefer attended a one-month disease training program at the National Wildlife Health Laboratory in Madison, Wisconsin, in 1984. He also received an introduction to necropsy, wildlife health sampling techniques, and diagnostic procedures.

Biologist Fefer attended the Pacific Seabird Group annual meeting in Asilomar, California. Fefer served on the Executive

Committee, Conservation - Committee, and was the Hawaii regional representative to the Pacific Seabird Group.

Complex Manager Shallenberger participated in a meeting with representatives of the U.S. Forest Service, The Wildlife Society, State Division of Forestry, and State Division of Wildlife to develop plans for a 1984 conference on Natural Resource Management on Hawaii's public lands.

Shallenberger was invited to represent the FWS on the Governor's Advisory Committee on the Humpback Whale National Marine Sanctuary and attended a committee meeting August 22 on Maui.

8. Other Items

Refuge and Wildlife Resources (RWR) staff have played a dual administrative role since establishment of the Honolulu Area Office. Refuge headquarters are located within the AO in the Federal Building in Honolulu. AO staffing (3) has been inadequate to handle the volume of AWP reporting and other tasks without substantial support from RWR and ES staff. Project leaders, in particular, have worn two hats. Not surprisingly, this dual role has impacted the ability of Refuge staff to keep up with the normal volume of work involved in the operation and management of 12 refuges and other technical assistance roles.

The following are highlight activities that occurred at the refuge during 1983 and 1984:

1983:

Shallenberger visited the Regional Office on January 10-11, to discuss administrative items. It was apparent from this quick visit that more frequent trips will be necessary to insure adequate representation in the R.O. As it is now, all other refuges in the region are represented by District Supervisors.

Regional office staff on show-me tour in the western Pacific spent some time at the Honolulu office. Included were William Meyer (Deputy Regional Director), William Shake (ARD/FA), Don Friberg (FA), Joe Blum (ARD/ENV), and Ed Chamberlain (Deputy ARW). They attended the Marine Mammal Commission meetings on the monk seal (February 25) and visited Hanalei NWR, Kilauea Point, and James Campbell NWR during one long day on February 26.

A general staff meeting with all R.O. and area staff was held on February 28.

Regional Office staff in Honolulu to review area programs visited Tern Island for a one-day trip in March. An administrative close-out meeting was held with project leaders and R.O. staff on March 3. Chamberlain was able to visit Pearl Harbor and Campbell NWR's with Coleman on March 1 and also visited Kanaha, Kealia and

Kakahaia ponds on March 8 with Shallenberger and Coleman. Although the visits by R.O. personnel took a lot of staff time, it is likely that the effort will be justified through greater understanding of our programs.

Regional and Washington Office staff attended the Tripartite symposium in Honolulu. Included were Ray Arnett, Robert Jantzen, Richard Myshak, Larry DeBates, Dick Bauer, and Paul Camp. Arnett, Myshak and Jantzen participated in a two-day trip to Tern Island and Kauai. After the symposium, R.O. staff (including Harvey Lee) remained in Hawaii for a three-day AWR evaluation conference with RWR staff. During this evaluation, all five wetland refuges were visited.

Shallenberger attended a research/management conference at Volcano National Park and presented information relating to priorities for wetland and remote island research/management projects involving listed species. Attending from the R.O. were Bill Meyer, Bill Shake, and Sandy Wilbur.

1984:

A number of R.O. visits were postponed due to the pending transition in Refuge Complex Managers. With Manager Shallenberger leaving in July and a new manager tentatively arriving in August, it was decided to put the scheduled administrative review off until early 1985.

Office of Aircraft Services representatives from Anchorage, Alaska, conducted a one-day workshop for Interior agencies on aircraft safety and contract administration. Four refuge staff members attended the workshop.

Regional Office acquisition staff conducted a one-day workshop on FWS acquisition. Two RWR and one ES staff member was in attendance.

Several Refuge staff members participated in the Fates and Impacts of Marine Debris Workshop presented by NMFS and FWS in Honolulu on November 26-29.

F. HABITAT MANAGEMENT

9. Fire Management

Richard Bottomley, Maintenance Worker at Kilauea Point Wildlife Administrative Site attended the FWS fire training course in Oregon in December, 1984.

10. Pest Control

Krakowski attended a water hyacinth control workshop presented by the U.S. Army Corps of Engineers in October 1984 in Honolulu.

G. WILDLIFE

2. Endangered and/or Threatened Species

In 1983, refuge staff met with SE staff regarding coordination on the revision of the Hawaiian Waterbird Recovery Plan, dated August 1977. The RWR staff will provide SE with a marked-up copy of the earlier plan for use in preparation of the updated plan. The Koloa (Hawaiian duck) will be added to the plan.

RWR staff reviewed the first draft of the NWHI Passerine Bird Recovery Plan, prepared by SE. Comments will be incorporated into a rewrite.

During 1984, Kilauea Point Wildlife Adminsitrative Site staff participated in the Kauai Newell's shearwater pickup program. The birds are attracted to lights from the surrounding area, including hotels and towns. The shearwaters are burrow nesters and upon fledging from the burrow, respond to light at night. They become confused and disoriented and fly into the lights. The birds also fly into standards, poles, wires, etc. associated with the light, then drop to the ground, stunned. Many perish, but a volunteer effort by the communities, spearheaded by refuge staff members, has allowed for pick up of the "drop outs" and rehabilitation of those birds that are salvageable. No figures were available on the number of birds recovered in 1984.

4. Marsh and Waterbirds

Refuge staff participated in both the January and August 1983 and 1984 semiannual waterbird census.

17. Disease Prevention and Control

In March, 1983, the wildlife manager for the contractor at Midway Islands notified RWR in mid-March that there was an outbreak of avian pox in Laysan albatross on Sand Island. Brady travelled to Midway Islands during March 24-31 to assess the problem. He reported that several hundred chicks were infected in a variety of areas on Sand Island. The refuge coordinated with the Midway command, PACDIV, University of Hawaii, several local veterinarians, Military Air Command, and the National Wildlife Health Lab (NWHL) in order to arrange an immediate survey of the problem on Midway. Fefer and Naughton (RWR Honolulu), Sileo and

Hanson (NWHL), and Gettman (University of Hawaii) travelled to Midway to further assess the problem, determine vectors, and supervise vegetation control by Navy Seabees. Photographic study plots were set up and photos of diseased birds taken to document progression of the disease. Reproductive success studies of 100 banded chicks with pox were initiated. Vectors were determined to be mosquitoes (Culex quinquefasciatus) and flies of several species. Biden alba, a composite exotic flowering plant, has become a dominant species in abandoned housing areas on Sand Island. The highest density of heavily infected birds were found in association with this vegetation and in the housing areas. This vegetation provides habitat for mosquitoes and flies. Navy Seabees volunteered to cut areas of thick vegetation where birds were infected. Many of these areas were mowed during the period from April 1-7 in order to help eliminate habitat for the vector. Water catchment areas where mosquitoes bred were contaminated with fuel to control mosquito populations. Most of the Laysan albatross chicks found with pox recovered before fledging. Reproductive success (chicks fledged/total chicks) of chicks with pox was not significantly different from chicks without pox.

Fefer (RWR) and Sileo (NWHL) travelled to Midway in July of 1983 to assess cause(s) of droop-wing in near fledgling Laysan albatross on Sand Island. They necropsied, sampled blood, and collected tissue for analysis from 20+ Laysan albatross fledgling and adults. Lead poisoning was found to be the cause of droop-wing and eventual death of Laysan albatross. fledglings. Lead poisoning was common in these birds in areas near abandoned buildings. Although lead poisoning undoubtedly caused droop-wing in the albatross, droop-wing is felt to be a symptom of weakened condition. Further study of droop-wing on remote islands will be required to assess the causes of the condition and mortality elsewhere.

Biologist Fefer spent one month in 1984 at the NWHL in Madison, Wisconsin, studying avian diseases and other wildlife diseases (see Technical Assistance, Other, page 18).

Environmental Services, the Pacific Islands Administrator, and RWR hosted a week-long workshop on avian diseases in December, 1984. Biologists and wildlife administrators from throughout the Pacific, as well as members of the NWHL in Wisconsin, attended to discuss the importance of avian disease, how serious it is, and what measures can be taken to alleviate it.

H. PUBLIC USE

1. General Use

In 1984, Dick Kuehner (AWR-I&R) visited the Hawaii Refuge Complex

between January 16-27 to review progress on I&R programs and to develop plans for future projects. During his visit, meetings were held with Campbell Estate and Department of Education representatives.

2. Outdoor Classrooms - Students

Refuge staff met with John Hawkins, Head of the State of Hawaii Department of Education, to discuss how the refuge can meet the needs of the Department for outdoor education sites. Topics included expanded use of James Campbell NWR facilities and Kilauea Point WAS.

7. Other Interpretive Programs

In March, 1983, sound-slide shows for wetland refuges and the HINWR were completed. Narration was done by Ted Scott and final recording and mixing was done at Commercial Sound Studios.

Throughout 1984, negotiations for permits and special conditions for use were undertaken with the Haraguchi family of Hanalei. At the close of the year, all paperwork was in order and restoration of the old Haraguchi Rice Mill on the Hanalei NWR, Kauai, was initiated.

17. Law Enforcement

Refuge staff attended a Federal Court hearing on August 31, 1983, in Magistrate Gedan's court regarding the illegal shooting of a migratory bird (greater frigatebird) in July at Kaneohe Marine Corps Air Station. Dewitt Baker pleaded guilty to the charge and was given the maximum fine of $500.

18. Cooperating Associations

In February 1984, the Memorandum of Understanding between the Service and the Kilauea Point Natural History Association was signed. This MOU establishes a Cooperating Association at Kilauea Point. Volunteers in the Association will operate the visitor facility at the Point. During the month of February, weekly training sessions for volunteers began under the direction of Park Ranger Don Moriarty. The training includes six 4-hour meetings over a six-week period.

I. EQUIPMENT AND FACILITIES

1. New Construction

A 14-foot windmill and an innovative fiberglass low-lift pump were put into operation during 1984 at the James Campbell NWR. See James Campbell NWR narrtive report for details on construction and operation of this prototype windmill and water/delivery system.

6. Computer Systems

Refuges received a Digital Rainbow Computer with a printer and modem for use in a variety of refuge tasks and for eventual use with the Refuge Management Information System. We have used this computer for Data Base Management of biological data, word processing, and budgeting. Refuges maintains a Superbrain computer, which has been used for simlar purposes. The use of computers has increased the productivity of refuge staff and has become an important component of the Complex program.

J. OTHER ITEMS

1. Cooperative Programs

The primary cooperative program underway during the 1978-1983 time period was the Tripartite Cooperative Study, pursuant to an agreement signed by FWS, National Marine Fisheries Service and the Hawaii Department of Land and Natural Resources in May, 1978. This agreement calls for a five year cooperative study of fish and wildlife resources in the Northwestern Hawaiian Islands (see Hawaiian Islands National Wildlife Refuge). These studies were culminated at the Symposium conducted in May, 1983. Results of the research conducted were presented.

Cooperative programs were also underway with State biologists, involving banding, auxiliary marking and the semiannual 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.

A fine example of the cooperative effort put forth on this station was demonstrated in March of 1983 when Fefer and Shallenberger conducted a marine bird survey at Wake Island on March 29-30. Transportation was provided on Col. John Parrish's jet on his quarterly visit to the island. Seabird colonies on Peale and Wilkes Islands were surveyed. Approximately 500,000 breeding sooty terns were with eggs and chicks on these two

islands. Also noted on Wilkes Island were nesting brown boobies (approximately 75 nests with eggs/chicks), masked boobies (one pair with young), red-footed boobies (339 nests with eggs or young), and a smaller number of great frigatebirds and red-tailed tropicbirds. Feral cats are presently causing some problems, particularly in the Wilkes tern colony. Eradication may eventually be possible, but only after the causeway separating Wilkes from Wake Island is removed. Trip reports and management recommendations on this visit and a July 1982 visit were provided to Col. Parrish. We will propose that a wildlife management plan be prepared and that periodic surveys be continued.

In cooperation with the military, Fefer and Shallenberger participated in a trip to Kahoolawe June 15-17, 1983, to determine if Newell's shearwaters or dark-rumped petrels are nesting on the island. The beginning of the trip was delayed by helicopter problems so we did not arrive on the island on the first day until 19:00. Evening surveys were conducted on both nights at the east end of the island, overlooking possible nesting areas in gulches or coastal cliffs. No shearwaters or petrels were heard or seen during this brief visit. Information on other wildlife was compiled. No further trips are planned at this time.

In February, 1984, refuge staff completed the Fish and Wildlife Management Plan for the Marine Corps Air Station (MCAS), Kaneohe Bay, Oahu, Volumes I and II. The MCAS contains some wetlands that provide habitat for several endangered bird species. The station also has one of the only two red-footed booby colonies in the main Hawaiian Islands. The plan states long-term management goals and covers specific management techniques.

3. Items of Interest

The following items of interest occurred in 1984:

Shallenberger and Krakowski attended a refuge manager programmatic conference from March 26-30.

Legislative aides Chris Dawson (Senator Evans, WA) and Craig Zamuda (Senator Breaux, LA) visited the refuge on May 25.

Leupold, WD-Budget Officer, visited the refuge on June 20; Bob Gilmore, Associate Director AFA-WO; and Paul Carothers, Legislative aide for Senator Breaux, Louisiana, visited the refuge on November 26.

Regional Director Myshak visited the refuge on October 12.

Various staff members participated in the following programs in 1984: (1) Talk on avian pox and malaria in native Hawaiian birds to the Leahi Clinic, Institute of Malaria, University of Hawaii; (2) seminar on Hawaiian seabirds to the Waikiki Aquarium Association; (3) oiled bird rehabilitation workshop at Honolulu

Zoo; (4) presentation at Hawaii Fish and Wildlife Conference in Honolulu and; (5) presentation on Hawaiian Islands NWR at the Western Regional Conference of the National Audubon Society held at Asilomar, California.

Refuge Complex Manager Shallenberger, followed by Manager Leinecke, filled a seat on the Hawaiian Monk Seal Recovery Team. Leinecke participated in the December, 1984, recovery team meeting held in Honolulu.

Refuge Complex Manager Shallenberger and Assistant Refuge Manager (Remote Islands) Ludwig figure prominently in Regional and National photo competition in 1983. A total of 21 regional and 1 national award(s) were taken:

In the Regional awards, Robert Shallenberger took the following awards:

1st Place (b/w)	"Monk Seal"	Threatened and Endangered
2nd Place (b/w)	"Hawaiian Hawk"	Species category
3rd Place (b/w)	"Vicia"	Species category
Hon. Mention (b/w)	"Close up/Hawaiian Hawk"	Species category
1st Place (b/w)	"Swallowtail"	Fish and Wildlife
2nd Place (b/w)	"Bufo Marinus"	Fish and Wildlife
3rd Place (b/w)	"Frigates"	Fish and Wildlife
Hon. Mention (b/w)	"Precarious Perch"	Fish and Wildlife
1st Place (b/w)	"Morning Rain"	General
2nd Place (b/w)	"Pattern in Nature"	General
3rd Place (b/w)	"Silver Sword"	General
Hon. Mention (b/w)	"Mountain Stream"	General
3rd Place (color)	"Dark-rumped Petrel"	Threatened & Endangered
3rd Place (color)	"Ohelo"	Fish and Wildlife
Hon. Mention (col.)	"Rose Atoll Coral"	Fish and Wildlife
3rd Place (col.)	"Opening Day"	Public Use
Hon. Mention (col.)	"Just Like Dad"	Public Use
1st Place (col.)	"Controlled Burn"	Work of the Service
Hon. Mention (col.)	"Clam Collection"	Work of the Service

Regional awards to Gerald Ludwig:

Hon. Mention (col.)	"Multiple Albatross"	Fish and Wildlife
2nd Place (col.)	"Rose Atoll Fish Survey"	Work of the Service

NATIONAL awards to Robert Shallenberger:

3rd Place (col.)	"Controlled Burn"	Work of the Service
3rd Place (b/w)	"Frigates"	Fish and Wildlife
3rd Place (b/w)	"Hawaiian Hawk"	Threatened and Endangered
Hon. Mention (b/w)	"Monk Seal"	Endangered category
2nd Place (b/w)	"Pattern In Nature"	General
3rd Place (b/w)	"Morning Rain"	General

National awards to Gerald Ludwig:

2nd Place (col.)	"Rose Atoll Fish Survey"	Work of the Service

In 1984, the PIA and refuge staff again made a strong showing in both the Regional and National photo contests. A total of 6 Regional awards and 4 national awards were received.

Regional awards to Bruce Eilerts:

1st Place (col.)	"Hawaiian Monk Seal and Red-footed Booby"	Rare & Endangered Species
2nd Place (col.)	"Laysan Finch"	Rare & Endangered Species
2nd Place (col.)	"White Tern Chick"	Fish and Wildlife
2nd Place (col.)	"Photographer and Sooty Tern Colony"	Public Use
3rd Place (col.)	"Bobcat"	Fish and Wildlife
Hon. Mention (col.)	"Gray's Lake NWR Observation Post"	Public Use

Dale Coggeshall entered photos for Region 5 contest.

NATIONAL awards for Dale Coggeshall:

Best of Show (col.)	"Red, White, and Blue of the Tropics"	Best of Show
1st Place (col.)	"Red, White and blue of the Tropics"	Fish and Wildlife
Hon. Mention (col.)	"Paradise at Sunset"	General

National awards for Bruce Eilerts:

Hon. Mention (col.)	"Bobcat"	Fish and Wildlife

4. Credits

Refuges and Wildlife Resources staff involved in preparation and review of the Narrative Report included: Jerry Leinecke and

Kathy Castelo, Complex; Richard Wass, Richard Vetter, Larry Martin, and William Cooke, Remote Islands; James Krakowski and Dan Moriarty, Wetlands; Dan Moriarty, Kilauea Point WAS; and Stewart Fefer, Darcy Hu and Ken McDermond, Biology. Shirley Hernandez and Anne Robb typed the manuscript. Photo credits are indicated by photographers initials, if photographer is known.

HANALEI NWR

Hanalei, Kauai, Hawaii

BI-ANNUAL NARRATIVE REPORT

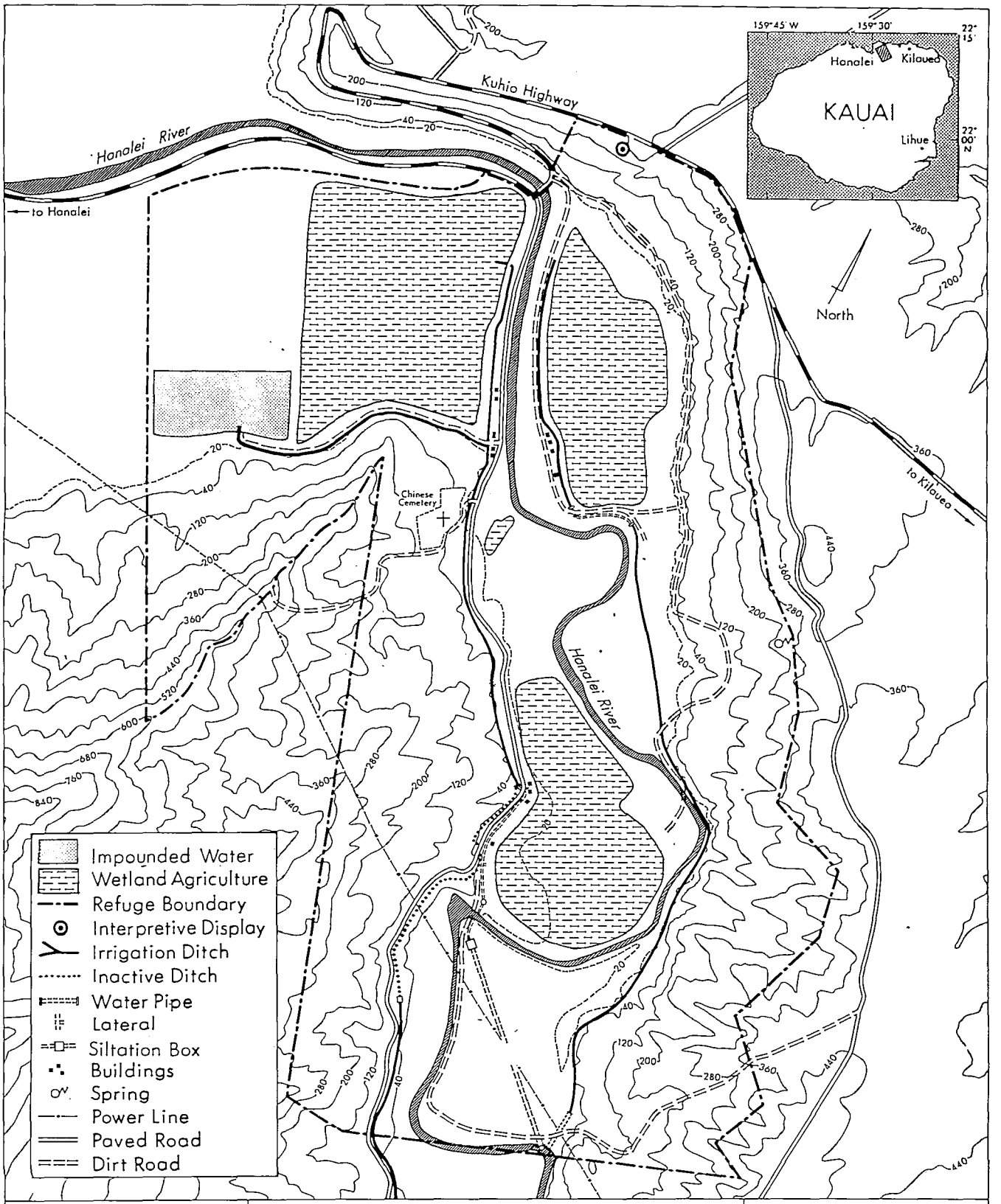
Calendar Years 1983 and 1984

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 flots, 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 loi (paddies) are recognized easily. The refuge maintains an interpretive display at this location. RWR staff.



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HANALEI NATIONAL WILDLIFE REFUGE

Hanalei, Island of Kauai, Hawaii

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

HANALEI NATIONAL WILDLIFE REFUGE

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A. HIGHLIGHTS

1983: In the fall, a 1000-foot, 48-inch diameter concrete pipeline was completed, connecting the existing pipeline to the existing intake, eliminating an 18-foot deep open ditch which presented innumerable maintenance problems.

A 20-acre impoundment with nesting islands was constructed in the Block D area to increase management options for nesting waterbirds.

1984: The exterior portion of the Haraguchi Rice Mill was completely rebuilt by late 1984. The rice mill is listed on both State and National Historic registers and was rebuilt through the efforts of a local non-profit group, the Haraguchi Rice Mill, Hoopulapula, using Federal historic preservation funds.

Taro prices and production quotas for individual farmers have both registered declines during 1984. Developments in the taro industry are important to refuge management interests as taro production impoundments provide most of the available wetlands at Hanalei. Long term taro market declines will ultimately lead to a reduction in wetland habitat.

Despite flooding for most of 1984, the newly constructed 20-acre impoundment continued to be clogged with *Bracharia* grass. Flooded from 1-3 feet of water, the grass showed meager growth but failed to succumb to the long term flooding. The high cost of herbicides and their application prevented chemical control of the species in 1984.

The Hawaiian Duck (Koloa) would utilize the flooded grass especially during the day periods; as normal winter rains resumed in late 1984, Koloa utilization dropped to a few birds.

B. CLIMATIC CONDITIONS

1983: Maintenance and clean up activity continued into CY 1983 as a result of Hurricane Iwa which struck the island on November 23, 1982, causing 100 million dollars damage and severing water, electric and telephone service for over a month. Removal of fallen trees on refuge properties continued into summer. Some areas of the island were still not fully functional by the end of CY 1983.

Weather data for Hanalei NWR:

Month	Rain (inches)	Temperature High	Temperature Low	Wind (MPH)
January	7.9	78.4	66.3	10.5
February	5.7	77.4	65.3	11.2
March	7.6	77.2	66.1	11.9
April	6.1	78.2	67.3	12.4
May	6.2	80.0	69.2	11.9
June	4.2	82.2	71.0	12.5
July	5.7	83.0	71.8	13.0
August	5.4	83.8	72.3	12.5
September	4.6	84.6	72.5	11.2
October	5.9	83.3	71.5	10.9
November	7.5	80.7	69.8	11.7
December	8.0	78.6	67.8	11.3
TOTAL	74.8	80.6	69.2	11.7

1984: The first three quarters of 1984 could be characterized as extremely dry. Several local records for low rainfall were established.

Low rainfall from January to October caused a reduction in water supply. East side farmers experienced reduced water despite repeated ditch cleaning.

1984 weather data for Hanalei National Wildlife Refuge:

Month	(inches)	Rainfall	High	Low	Winds (mph)
January	4.24	8.7	79.5	68.1	13.0
February	3.92	6.6	79.0	68.4	14.5
March	4.75	9.6	82.4	68.0	12.8
April	5.81	8.2	81.5	71.2	17.8
May	4.17	6.9	83.0	73.3	15.5
June	4.88	4.8	84.0	74.5	16.9
July	2.37	6.5	85.0	75.2	14.2
August	1.92	6.4	85.5	74.4	14.1
September	3.75	5.4	85.0	78.0	11.9
October	2.44	6.6	83.3	71.5	10.8
November	23.66	8.9	80.7	69.8	11.7
December	9.69	8.8	78.6	67.8	11.3
TOTAL	71.60	87.40	82.3	71.7	13.7

C. LAND ACQUISITION

2. Easements

1983: In October, Hawaiian Telephone sought an easement through refuge lands to bring service to valley residents. The utility company was advised to work with the County of Kauai to establish the exact location of unsurveyed 30-foot roadway through the valley.

D. PLANNING

4. Compliance with Environmental Mandates

1983: Refuge staff worked with the Haraguchi family in their efforts to place the family rice mill on the State of Hawaii and National Register of Historic Places and obtain historic restoration grant funding for the building and the milling equipment.

After inclusion in the register in early summer, staff efforts were directed toward reviewing appropriate tenure options for the building. Concurrently, the Haraguchi's formed a non-profit corporation called the Hoopulapula Haraguchi Rice Mill and proceeded to secure the necessary State of Hawaii non-profit registration in late 1983. The Hoopulapula Haraguchi Rice Mill Corporation was able to obtain a $32,500 grant from the Historic Preservation Acquisition and Development Grant Program for reconstruction of the building.

A SUP will be issued in early 1984 to regulate the reconstruction and proposed public activities of the building.

Shallenberger and Moriarty attended a Cultural Resources Management meeting in Corvallis, Oregon, October 24-28.

1984: The Haraguchi Rice Mill, a State of Hawaii (June 1983) and National Register of Historic Sites property (August 1983), was structurally restored during the year.

The rice mill and its rice milling equipment are being restored by a non-profit corporation called the Hoopulapula Haraguchi Rice Mill under a Special Use permit issued by the Service. The rice milling restoration will attempt to focus on rice, a crop once the mainstay of the entire Hanalei economy at the turn of the century and the Haraguchi family as representatives of immigrants of Japan to Hawaii.

The old structure, blown down in Hurricane Iwa, was cleaned up in early winter. The original concrete foundation was repaired and

rough framing and exterior covering finished by late summer. The building was reconstructed in accordance with The National Park Service drawing completed in August 1982, before the original structure was destroyed.

Refuge staff, in accordance with the National Historic Preservation Act of 1966 (16 USC 470), worked with Hoopulapula Haraguchi Rice Mill to augment its responsibility in the reconstruction and conservation of this unique cultural property.

The restoration was structurally complete by late 1984.

5. Research and Investigation

1983: Hawaiian moorhen nesting ecology was monitored through 1983 by refuge staff. A total of 34 nests were reported.

Two Hawaiian stilt nests were reported and monitored in 1983. Neither were successful due to cat or dog predation.

1984: Staff participated in the semiannual waterbird census during the period.

E. ADMINISTRATION

1. Personnel

1983: Assistant Refuge Manager Brady transferred to Pahranagat NWR on April 3, 1983. Maintenanceman Moriarty was transferred to the newly created Park Ranger position with new duties to include expansion of the Kauai Refuge Complex's interpretive programs, formation of a cooperating association, and development of a volunteer program. The maintenanceman position was filled on a temporary basis by William Lemn until May when he left to return to farming. Richard Bottomley completed the year on a temporary appointment. Wetlands Assistant Manager Coleman transferred to a position in Washington, D.C. in July. A new replacement was unavailable for the remainder of 1983.

1984: The consistent staff throughout both years:

Dan Moriarty - Park Ranger
Noreen Bautista - Clerk-typist
Richard Bottomley - Maintenance Worker

Jim Krakowski replaced Rick Coleman as Refuge Manager (Wetlands) in January.

Jerry Leinecke replaced Rob Shallenberger as Refuge Complex Manager in August.

2. Youth Programs

1983: A 6-week non-residential YCC camp was held at Kilauea Point from July 5 to August 26. Six enrollees and a work leader were hired under the Student Conservation Association. Most of the work was done at Kilauea WAS, however, a few small projects took place at Hanalei.

1984: A non-residential Youth Conservation Corps camp was held on Kauai from June 10 to August 3. Damien Baptiste was hired as YCC Crew Leader under the Student Conservation Association and supervised 6 enrollees.

A GSA station wagon and refuge pick up truck picked up and returned enrollees to the designated pick up at Kilauea Post Office.

Although most of the YCC projects were done at Kilauea Point, a few small projects took place at Hanalei.

6. Safety

Regular safety meetings were conducted throughout both years, including both staff and volunteers. Unsafe and hazardous conditions were noted and corrective actions taken. In April, CPR training was successfully completed by all staff members and several volunteers.

1984: Emergency procedures to safely and effectively facilitate fire, police, and ambulance response at Kilauea Point were developed with the agencies involved. Each volunteer was briefed as to the procedures.

Bottomley completed Basic Fire Management Training on December 7. All staff members and YCC work Leader completed Defensive Driving Course on May 31.

7. Technical Assistance

1983: On June 30, Norm Holgerson, Wildlife Biologist, Animal Damage Control, California, visited Kauai. He was briefed on the following refuge predation problems: Myna bird/wedge-tailed shearwater egg predation, dog, cat owl, cattle egret, and black-crowned night heron predation and winter coot damage to taro fields.

1984: Refuge staff worked with Princeville Golf course management to abate Hawaiian coot damage to golf greens adjacent to ponds used by the coot. Attempts were made to educate the irate golfers by providing the greens committee with information on the endangered status of the Hawaiian coot and photographs comparing the frontal shields of the common North American coot with the endangered Hawaiian coot.

It is planned that a high quality interpretive panel be placed in a conspicuous place along the fairway to inform golfers of this unique bird.

A 1-foot high fence was erected at the pond and greens to act as a terrestrial barrier to coot movement. This effort was somewhat successful in containing the birds, however, it caused some irritation to the golfers and was ultimately removed.

Coots moved out of the area during the third quarter.

8. Other Items

1983: On June 1, evaluation for the Kauai Refuges was conducted by Larry DeBates, Assistant Regional Director (AWR), Dick Bauer,

Senior Staff Specialist (PD), Harvey Lee, Program Analyst (PD), Rob Shallenberger and Rick Coleman.

Communications between the State of Hawaii, Department of Agriculture and USFWS regarding the Hanalei Agricultural Park Agreement was minimal through 1983. New developments such as the recent 10% price drop per bag of taro, the lack of qualified new farmers and the apparent failure of new permittees on the refuge has lead both parties to approach the agreement with a delayed caution.

1984: On March 8, refuge revenue sharing check for $15,025 was presented to the Treasurer, County of Kauai.

No action has been taken on the proposed State of Hawaii Agricultural Park on Hanalei NWR. Caution prevails between both parties as attempts to assess recent declines in the taro industry continues.

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), which are located on both sides of the Hanalei river. The 4"-6" water depth maintained by the taro farmers is the ideal water depth for the four endangered Hawaiian waterbirds: Hawaiian stilt, coot, moorhen, and duck (koloa).

The river flows north through the middle of the refuge providing additional wetland habitat. Some of the 298 acres of grassland

which surround the taro fields will eventually be converted to taro fields. The forested slopes (458 acres) along most of the refuge perimeter provide an excellent buffer zone for the wetland.

4. Croplands

1983: In February, Hideo Watari and Mrs. Diego completed construction of a raised roadway and ditch section connecting their fields with the Little China Ditch. After completion of the ditch hook-up, taro planting continued until the end of 1983.

After several warnings, the Dawa taro SUP was terminated in mid-summer as a result of her failure to maintain taro production in her 1.95-acre permitted area.

Permittee Victor Punua notified the refuge in late summer that he will discontinue his taro SUP.

The University of Hawaii notified the refuge that it could only cultivate 2.5 acres of land at Hanalei rather than the 10 acres originally permitted to them.

Water discharge at Lateral 00 was improved by the installation of a weir within the concrete distribution box. Refuge staff under supervision of Pete Cation completed the work.

Taro prices paid to the taro farmers by the Honolulu Poi Mill was reduced by 10% in October.

Existing taro farmers utilized marginal portions of their permit for a net gain of 10 acres of flooded cropland.

1984: The taro industry, which utilizes approximately 150 acres in the lowlands of the Hanalei Valley, have suffered marketing setbacks during 1984 both in taro price and production quotas. Increases in Hanalei production acreage has been noted annually since 1975. During 1984, the acres in production declined from the previous year for the first time in 10 years. Haraguchi, Watari, and Alapai permits have shown decreases in production.

1984 was an exceptionally bad year for waterbird crop depredation. Commencing in January and ending in October, incidents of coot flocks eating both young and mature taro leaves were observed.

Permittee Wallace Koga suffered extensive damage to 2 fields. Flora Mateo and W.T. Haraguchi Farm suffered some damage. Approximately 3 acres valued at $15,000 were destroyed.

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

6. Other Habitats

1983: A supply ditch was extended approximately 700 feet and a 20-acre impoundment with nesting islands was created in Block D. Lack of funds prevented grading of bottom to exact elevations, however, utilization by Hawaiian ducks (Koloa) often exceeded 125 birds when high water levels were maintained. A leaky dike required repairs in December.

1984: In addition to taro, a 20-acre impoundment and flooded pasture provide alternate waterbird habitat. The 20-acre impoundment has been overgrown with an aggressive grass, *Brachiaria*, despite attempts at flooding the weed.

The tall grass appears unattractive to the waterbirds with the exception of the Hawaiian Duck (Koloa) who utilize the impoundment, especially during dry periods.

Dry weather reduced water bird utilization of seasonally flooded pastures during the first three quarters of 1984, however, rains increased utilization in late 1984.

The 20-acre wetland impoundment was completed in 1983. RWR staff

In 1984, Brachiaria grass dominates the pond. RWR staff

7. Grazing

1983: Grazing Permittee Apao's final appeal to the USFWS Director was denied by letter on April 8, 1983. Apao was ordered to leave the refuge by June 8, 1983. All his fencing property and equipment was removed by July 25. With the removal of the Apao permit and the loss of grazing lands in Block D to the construction of the new impoundment, approximately 70 acres remained under grazing permit at the end of 1983.

1984: Approximately 132 acres of grazing land exist on Hanalei NWR. A total of 3 grazing permits are current on the refuge, Mahuiki (26.14), Tai Hook (17.5), and Princeville Cattle Company (88).

The main benefit of grazing to refuge management are the maintenance of open predator-free buffer areas and the seasonal usage of close-grazed pasture areas by waterbirds.

Some problems were encountered by loose cattle in taro permit areas or along water conveyance and impoundment structures. Staff must determine damage and contact owners, negotiate between involved parties regarding the damage to crops and irrigation structures, and check fencing to prevent future escapes.

10 Pest Control

1983: Four dogs and fourteen cats were removed from the refuge by trapping.

26 "wild jungle fowl", which damaged taro, were destroyed.

Wild cattle occasionally damaged permittee and refuge property. Considerable time was spent locating owners and in constructing exclusions to keep them confined.

In April, a feral pig problem was reported.

1984: 45 "wild jungle fowl", which reportedly damaged taro corms, were destroyed.

Two dogs and seven cats were destroyed.

Feral pigs increased to the point where up to fifteen pigs entered the refuge and destroyed taro crops. Affected farmers were given permission to protect their crops by capturing and destroying offending animals. Several pigs were captured and destroyed, however, an increase in the feral pig population in late 1984 was noted.

Cattle egrets, suspected predators of Hawaii's wetland birds, altered their social and nesting behavior during the last 2 years. After Hurricane Iwa in late 1982, they abandoned many of their older-known rookeries and moved into new areas.

Large concentrations of egrets have been observed in the upper valleys at Hanalei, however, a rookery has not yet been located. An increase of this species in the Hanalei Valley may be detrimental to waterbirds.

G. WILDLIFE

2. Endangered and/or Threatened Species

Population data were gathered monthly for the four endangered species found on the refuge: Hawaiian duck, moorhen, coot, and stilt.

1983: Hawaiian Duck - This species is difficult to count for several reasons. There is apparently 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, but refuge populations tended to be higher in winter than in summer. Up to 93 birds were seen on the refuge, but counts averaged 36 birds.

The Hawaiian duck (Anas wyvilliana). Hawaiian name is koloa moali. This male displays a plumage pattern that resembles a drake mallard. JK

Hawaiian Moorhen - Moorhen are relatively secretive and therefore difficult to count. Peak counts exceed 44, but average counts were about 35. Population estimates are 80-100 birds on the refuge. Thirty-four nesting attempts were documented in 1983 in the dense taro patches. Eighteen nests were successful. Many were later destroyed by flooding.

Hawaiian Coot - In wet periods this species apparently moves from Kauai to Niihau Island (30 km to the west) where ephemeral habitat are usually flooded by winter rains. In wet winters, like 1982, the species remains at Niihau until the wetlands dry up. The average coot population was less than 60 birds in spring and summer and less than 200 birds in the fall. No coot nesting attempts have been observed on the refuge.

Hawaiian Stilt - Like the coot, the stilt is believed to migrate to Niihau during wet periods. The wet spring/summer population average 8 stilts, while the drier fall months averaged 60 stilts. Nesting at Hanalei is restricted to narrow dikes between taro fields. Two stilt nests were located in 1983.

Bill Lemn takes measurements on a stilt nest on Hanalei NWR in 1983. RWR staff.

1984: Hawaiian Duck - The monthly census indicates that up to 100 individuals have been observed on the refuge with an average of 32 individuals. The highest counts correlate with long periods of low rainfall.

No nests were reported on the refuge during 1984, however, a few isolated nests have been reported over the years.

Hawaiian Moorhen - The Hawaiian moorhen, with the exception of a brief courtship period, are very secretive, often keeping well concealed under a canopy of taro leaves.

A peak count in November indicated 28 birds were present.

A total of 11 nesting attempts were reported at Hanalei during 1984; less than 10% were successful. An unknown predator, possibly an egret or black-crowned night heron, pierced several eggs.

Hawaiian Stilt - The Hawaiian stilt population fluctuates throughout the year apparently taking advantage of new habitat created by marginally flooded wetlands outside the refuge.

Speculation exists that the Kauai population of Hawaiian stilt migrates to nest on Niihau.

Nests are generally constructed in the spring on open barren taro field dikes. In the past, up to 8 nests per year have been reported at Hanalei. Few are successful. In 1984, no nests were reported on the refuge.

As the stilt prefers open areas for feeding and maintenance, population figures are a good reflection of actual populations. The 1984 population indicated a range of 6-120 individuals and an average of 58 birds.

Hawaiian Coot - A sub-species of the North American coot, the Hawaiian coot's population at Hanalei fluctuates throughout the year. Population ranges from several hundred to a handful.

Local conjecture suggests the northern Kauai population migrates to Niihau when Kona rains expand Niihau's wetland habitat. Population analysis directly correlate with this theory, however, a population shift does occur.

During the first three quarters of 1984, the coot population on northern Kauai, including Hanalei NWR, was generally high. It should be noted that Kauai rainfall was exceptionally low for this period. During the last quarter of 1984, when normal winter rains resumed, Hanalei populations began to decline. No nesting occurred during 1984 or in previous years.

Coot depredation of taro plants caused the loss of several acres of production. Refuge staff worked with affected farmers to reduce depredation by constructing enclosures and harassing birds out of newly planted fields.

3. Waterfowl

In addition to the native Hawaiian duck, incidental sightings of migratory waterfowl during both years have included pintails, blue-winged teal, northern shovelers, green-winged teal, and domestic mallards.

4. Marsh and Waterbirds

Black-crowned night herons occurred regularly on the refuge during 1983 and 1984. Counts ranged up to 15, but the average was 8 herons. The heron is known to take chicks and eggs of other birds, and there is a possibility that it preys on endangered moorhens (the only common nester on the refuge of the four endangered species).

Cattle egrets are an introduced species observed with suspicion owing to it's aggressive feeding habits and its potential for dramatic population increases. The cattle egrets' presence on the refuge has shown very little increase over the last 5 years. Approximately 25-100 birds are seen scattered throughout the refuge after concentrating in areas of disturbance to feed.

Cattle egrets were the suspected predator of this moorhen nest. RWR staff.

5. Shorebirds, Gulls, Terns, and Allied Species

Approximately 80-100 American golden plover winter at Hanalei NWR each year. Migratory shorebirds include wandering tattler, ruddy turnstone, sanderling, common snipe and occasional dowitchers.

11. Fisheries Resources

The aquatic fauna in Hanalei National Wildlife Refuge is found in the taro fields, adjacent wetland, 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), which exist in the taro fields. Chironomids are abundant in shallow water, while tubificids can flourish in wet and dry environments. Bird feeding is the most intense 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 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

1. General

1983: Several local and national media presentations featured Hanalei NWR, including National Geographic, KHET TV, and the Department of Education Superintendent's Report to the State.

Paramount Pictures filmed the opening scene and portions of the movie "Uncommon Valor" at Hanalei in August. The film was released in late 1983.

1984: Hanalei National Wildlife Refuge was mentioned in several National Geographic publications such as "Wild Lands for Wildlife", "Our Threatened Inheritance", and "Our Federal Lands".

The Hawaii Museums Association group of 90 museum directors and staff visited the Haraguchi Rice Mill on November 11.

2. Outdoor Classroom - Students

1983: A YMCA residential camp located 10 miles west of the refuge conducts an active year-round camp which takes in local school groups for 5 days of wildlife exploration. Visits to the Hanalei NWR are included in this program. The refuge staff conducts an annual training program for the camp leaders. A total of 540 students are involved in refuge visits through this program.

1984: The YMCA residential camp located 10 miles west of the refuge conducted several outdoor education sessions at Hanalei National Wildlife Refuge. A total of 150 students visited Hanalei through this program.

Refuge staff conducted several outdoor education sessions with local and off-island school groups at Hanalei. A total of 472 students were given an orientation to the U.S. Fish and Wildlife Service and the Hanalei National Wildlife Refuge.

3. Outdoor Classroom - Teachers

1983: The Park Ranger meets on a regular basis with public and private school teachers to assist in planning the proposed field trips to the refuge. Specific visit objectives and pre-visit information packets are given to teachers.

An informal field trip evaluation is conducted after each visit.

1984: A total of 55 teachers were given an orientation to the U.S. Fish and Wildlife Service and the Hanalei National Wildlife Refuge during the period.

6. Interpretive Exhibits/Demonstration

1983: A panel display at the Hanalei Valley overlook constructed in 1980 continues to provide information on the taro and endangered Hawaiian waterbirds found in the Hanalei NWR. Approximately 328,450 persons viewed the refuge and had access to the interpretive panels.

1984: Approximately 385,647 persons viewed the refuge and had access to interpretive panels. This figure represents an increase of 17.4% from 1983.

9. Fishing

The Hanalei River attracts recreational and part-time commercial fishermen who fish mainly for several species of gobies, a diadromous species commonly caught in late fall or early winter in the Hanalei River.

Crabbing and fishing for mullet and aholehole is commonly practiced in the Hanalei River.

11. Wildlife Observation

1983: In the last few years, there has been an increase in refuge visitation by small specialized groups such as museum, college or university sponsored Hawaiian History tours, Audubon Chapter-sponsored birding tours, and specialized commercial wildlife tours such as Nature Expeditions International and Questers.

Approximately 1,200 persons visiting the refuge could be described as wildlife observers.

1984: Refuge visitation by small specialized groups such as museum, college or university sponsored Hawaiian History tours continued in 1984.

Approximately 19,300 persons visiting the refuge could be described as wildlife observers.

17. Law Enforcement

1983: Several reports of marijuana growing were investigated by refuge staff. No clear evidence to link specific individuals with cultivation or possession was established. Several

trespassing individuals were given warnings.

1984: Most law enforcement violations involved trespassers and aircraft (helicopter) harassment.

Several reports of marijuana growing have been checked out, but no violators were apprehended.

I. EQUIPMENT AND FACILITIES

1. New Construction

1983: 1,000 feet of 48" concrete pipe was installed under contract by Ron's Construction, Honolulu. In addition to the pipeline, the Little China Ditch was lengthened and a 20-acre impoundment with nesting islands was completed on the east side.

A portion of the 48" concrete pipe that was installed in 1983. RWR staff.

1984: The new construction berm on the west side of the 20-acre Hanalei habitat impoundment, which washed in late 1983, was back filled and grouted rock was installed for additional protection. The pond was refilled in March.

On December 8, it was discovered that the Flora Mateo residence had been demolished and a new residence was under construction. Construction was immediately halted and Mrs. Mateo was required to submit plans to the County and Kauai Building Department for structural, health, and safety compliance with local requirements.

2. Rehabilitation

1983: An eroded dike section on the west end of the newly constructed 20-acre impoundment was backfilled, compacted, and grouted in December.

A deteriorated flume section on the Kuna ditch was repaired by Ron's Construction from a design made by Pete Cation and approved by Portland Engineering staff. The improvement worked well into 1983.

3. Major Maintenance

1984: Weedy vegetation was controlled quarterly in and around water control and conveyance structures.

Attempts were made to keep the 20-acre impoundment berm open for vehicular traffic; deep ruts and expansive vegetation will make this an ongoing project.

J. OTHER ITEMS

3. Items of Interest

1984: Jim Leopold, Budget Officer, USFWS Washington, visited Kilauea Point on June 19. Mr. Leopold inspected Hanalei, Huleia, and Kilauea Point.

Regional Director Myshak visited Kilauea point in October.

Robert Gilmore, Associate Director of Federal Assistance, visited Hanalei NWR and Kilauea Point on November 28.

HULEIA NATIONAL WILDLIFE REFUGE

Kauai, Hawaii

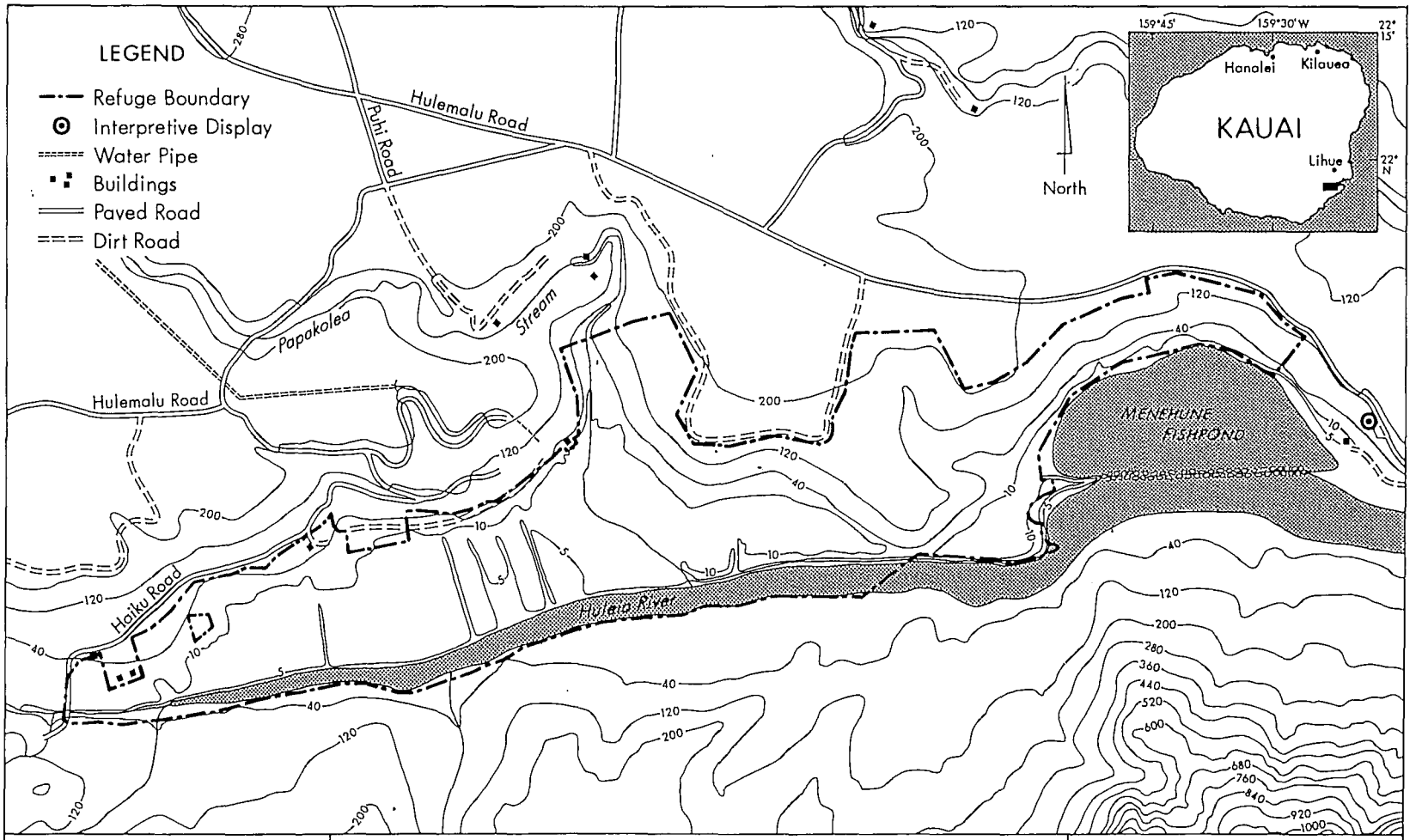
BI-ANNUAL NARRATIVE REPORT

Calendar Years 1983 and 1984

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.



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

A. HIGHLIGHTS

1983: A stream gauge was installed in August on the Papakolea Stream by Regional Office Hydrologist McVein, refuge staff, and YCC crew. Refuge permittee Lara cleared weedy vegetation from 20 acres of Huleia land. Several deaths among Huleia residents and heirs has prompted several inquiries to the complex office regarding our intentions at Huleia. Kauai River Adventures was given a Special Use Permit to conduct guided kayak tours along the Huleia River. Portions of the Paramount Pictures "Uncommon Valor" were filmed in Huleia.

1984: Bottomley and Moriarty, using the aluminum boat with 5 hp. motor, made a thorough inspection of the river portion of the Huleia National Wildlife Refuge. The intial survey indicated that river traffic through the refuge far exceeds road traffic.

A second kayak company proposed an outrigger canoe landing area. A Special Use Permit will be issued in 1985.

Kauai Adventure Tours, Special Use permittee, reported an increase of 333% in public use from the previous year.

Refuge permittee Lara eradicated an impressive amount of weedy vegetation in the lower pasture of Huleia NWR.

Moriarty and Vernon Byrd attempted to relocate boundary markers on Huleia without much success due to the effects of Hurricane Iwa and dense vegetation.

B. CLIMATIC CONDITIONS

1983: Maintenance and clean-up activity continued into CY 1983 as a result of Hurricane Iwa which struck the island on November 23, 1982, causing 200 million dollars damage and severing water, electric, and telephone service for over a month. Removal of fallen trees on refuge properties continued into the summer. Some areas of the island were still not fully functional by the end of CY 1983.

Weather data for Huleia NWR for 1983:

Month	Rain (inches)	Temperature High	Temperature Low	Winds (MPH)
January	6.24	77.9	64.4	10.5
February	4.28	77.9	64.4	11.2
March	4.67	77.9	65.4	11.9
April	8.25	79.2	67.3	12.4
May	3.43	81.4	69.5	11.9
June	1.57	83.3	71.7	12.5
July	1.87	84.0	72.7	13.0
August	2.21	84.6	73.6	12.5
September	1.85	84.8	72.8	11.2
October	3.84	83.3	71.3	10.9
November	5.63	80.8	69.6	11.7
December	6.34	78.2	66.8	11.3
TOTAL		81.1	69.0	11.8

1984: The first three quarters of 1984 could be characterized as extremely dry. Several local records for low rainfall were established.

1984 weather data for Huleiā National Wildlife Refuge:

Month	1984 Rain (inches)	30 Year Average Rainfall	Temperature High	Temperature Low	Winds (MPH)
January	2.19	6.24	79.5	68.1	13.0
February	2.17	3.68	79.0	68.4	14.5
March	2.68	4.52	82.4	68.0	12.8
April	4.78	3.29	81.5	71.2	17.8
May	1.33	2.99	83.0	73.3	15.5
June	.07	1.64	84.0	74.5	16.9
July	1.25	2.03	85.0	75.2	14.2
August	.70	1.85	85.5	74.4	14.1
September	3.23	2.25	85.0	78.0	11.9
October	1.94	4.52	83.3	71.5	10.8
November	15.00	5.55	80.7	69.8	11.7
December	6.00	5.46	78.6	67.8	11.3
TOTAL	41.34	44.02			

C. LAND ACQUISITION

1. Fee Title

1983: Consolidation of 3 refuge inholdings was not achieved in this CY. Several deaths which occurred in this year may affect the remaining heirs. Realty Office in Portland advised of deaths.

1984: Deaths in 1983 amongst Huleia Valley inholding heirs has resulted in several inquiries as to our intentions and boundaries of existing inholdings.

A telephone request for ownership verification was forwarded to Scott Wise, Realty.

Larry Coe, Realty, inspected Huleia kuleana inholdings. Coe will attempt to resolve Kanoho acquisition in anticipation of impoundment construction.

D. PLANNING

4. Compliance with Environmental Mandates

1983: Shallenberger and Moriarty attended a Cultural Resources Management meeting in Covallis, Oregon, October 24-28.

5. Research and Investigations

1983: The waterbird population census is conducted monthly.

E. ADMINISTRATION

1. Personnel

1983: Assistant Refuge Manager Brady transferred to Pahranagat NWR on April 3, 1983. Maintenanceman Moriarty was transferred to the newly created Park Ranger position with new duties to include expansion of the Kauai Refuge Complex's interpretive programs, formation of a cooperating association, and development of a volunteer program. The maintenanceman position was filled on a temporary basis by William Lemn until May when he left to return to farming. Richard Bottomley completed the year on a temporary appointment. Wetlands Assistant Manager Coleman transferred to a position in Washington, D.C. in July. A new replacement was unavailable for the remainder of 1983.

1984: Kauai FWS staff consisted of:

Dan Moriarty - Park Ranger
Noreen Bautista - Clerk-typist
Richard Bottomley - Maintenance Worker

Jim Krakowski replaced Rick Coleman as Refuge Manager (Wetlands) in January.

Jerry Leinecke replaced Rob Shallenberger as Refuge Complex Manager in August.

In March, Bob McVein and Bill Striplin inspected lower Huleia Valley to provide engineering expertise should impoundment development funds become available in 1985.

2. Youth Programs

1983: A six-person YCC program was held between July 5 and August 26. Richard Bottomley served as Camp Leader. Most of the work was done at Kilauea WAS and Hanalei, however, a few small

projects took place at Huleia.

1984: A non-residential Youth Conservation Corps camp was held on Kauai from June 10 to August 3. Damien Baptiste was hired as YCC Crew Leader under the Student Conservation Association and supervised 6 enrollees.

A GSA station wagon and refuge pick up truck picked up and returned enrollees to the designated pick up at Kilauea Post Office.

Although most of the YCC projects were done at Kilauea Point, the YCC enrollees spent one day at Huleia repairing and cleaning refuge boundary signs.

6. Safety

1983: Regular safety meetings were conducted throughout the year, including both staff and volunteers. Unsafe and hazardous conditions were noted and corrective actions taken. In April, CPR training was successfully completed by all staff members and several volunteers.

Periodic safety meetings were conducted by Safety Chairman Bottomley. Unsafe and hazardous conditions were discussed and corrective measures taken. Bottomley placed safety posters in appropriate locations and rotated them monthly.

All staff members and several volunteers have completed CPR and multi-media First Aid.

A map of possibly hazardous routes used by Special Use permittee Kauai River Adventures, was prepared for Honolulu and Portland office action.

Bottomley completed Basic Fire Management Training on December 7.

All staff members and YCC Work Leader completed Defensive Driving course on May 31.

7. Technical Assistance

1983: On June 30, Norm Holgerson, Wildlife Biologist, Animal Damage Control, California, visited Kauai. He was briefed on the following refuge predation problems: myna bird/wedge-tailed shearwater egg predation; dog, cat, owl, cattle egret, and black-crowned night heron predation; and winter coot damage to taro fields.

8. Other

1983: On June 1, evaluation for the Kauai refuges was conducted by Larry DeBates, Assistant Regional director (AWR), Dick Bauer, Senior Staff specialist (PD), Harvey Lee, Program Analyst (PD), Rob Shallenberger, and Rick Coleman.

1984: On March 8, refuge revenue sharing check for $15,025 was presented to the Treasurer, County of Kauai.

F. HABITAT MANAGEMENT

2. Wetlands

The refuge was acquired in 1973 to serve as a wetland refuge for 4 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 low lands provide only marginal wetlands.

1983-1984: As no operational or new construction funds are available to develop the area into wetlands, refuge efforts have been concentrated on preventing exotic vegetation from overgrowing the lower areas.

Funding requests have been submitted for impoundment development.

7. Grazing

1983: A 158-acre grazing Special Use Permit has been issued. The permittee has been very active in controlling weedy vegetation in his area. Working on a part-time basis, permittee Lara cleared approximately 20 acres of *Pluchea*, *Caesalpinia*, and mangrove by the years end.

After heavy rains, the newly open areas hold standing water for several weeks.

1984: Permittee Lara has been very active in controlling weedy vegetation in his area.

Refuge permittee Lara cleared brush in the lowlands of Huleia NWR during 1983 and 1984. DM

G. WILDLIFE

2. Endangered and/or Threatened Species

The refuge was created to provide habitat for the endangered Hawaiian moorhen, coot, stilt, and duck. During 1983 and 1984, Huleia NWR provided limited habitat for an average of six Hawaiian ducks and only one or two Hawaiian coots, moorhens, or stilts were observed on the monthly census 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 35 cattle egrets (introduced) and 2 black-crowned night heron were observed on the refuge during 1983 and 1984.

Refuge staff conduct monthly waterbird counts at Huleia NWR. DM

6. Raptors

A short-eared owl, Pue'o, and a barn owl were irregularly seen at the refuge during 1983 and 1984.

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.

1. General

1983: Filming of portions of Paramount Picture's "Uncommon Valor" were filmed on Huleia.

Visitors to the nearby historic Alakoko Fishpond have the opportunity to view portions of the Huleia refuge from an elevated roadside turn-out. A total of 18,200 visitors were recorded at this overlook.

No specific educational programs were conducted at this site in 1983.

1984: Visitors to the nearby historic Alakoko Fishpond have the opportunity to view portions of the Huleia refuge from elevated roadside turn-out. A total of 31,427 visitors were recorded at this overlook.

7. Other Interpretive Programs

1983: In April, a Special Use Permit was issued to Robert Crane, Kauai River Adventures, to conduct guided kayak tours along the Huleia River. The guided tours resulted in 2,499 visitors to the refuge. Information on the National Wildlife Refuge System and the purpose of the Huleia refuge are included in the tour narrative.

1984: The Special Use Permit issued to Robert Crane, Kauai River Adventures, to conduct guided kayak tours along the Huleia River resulted in 8,322 visitors to the refuge, which was 5,823 more persons than in 1983. This figure represents an increase of 333%.

Problems were encountered with the kayak company due to parking on roads and other resident's property and disturbance due to loud noise.

A second kayak company requested a Special Use Permit to land on the refuge.

9. Fishing

Recreational fishing and crabbing by boat is limited to the Huleia River. No detailed counts are taken, however, staff estimates 12 persons per week used the river in 1983 and 1984.

17. Law Enforcement

1983: The refuge staff has received several complaints from grazing permittee Lara contending that his cattle are being stolen. More frequent "spot checks" have been conducted, but no evidence of rustling has been observed. Moriarty met with Deputy Police Chief Sheldon in August to discuss the problem. Four break and entry reports were reported by SUP permittee involving a van and a small storage building.

1984: On November 23, several hunters who were gaining access to pig hunting grounds on adjacent property were cautioned not to use the area.

INTRODUCTION

The James Campbell National Wildlife Refuge consists of 142 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 (104.5 acres) consists of manmade ponds formerly established in 1977 to provide habitat for Hawaii's four endangered waterbirds (stilt, coot, moorhen, Hawaiian duck) and other native wildlife. After the closure of the Kahuku Sugar Mill resulted in the drying of the Kii settling ponds (formerly heavily used by water birds), the James Campbell NWR was established to return habitats to their 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 ways and a 40 hp. electric pump for flood control.

The Kii unit of James Campbell NWR--a series of 7 ponds artificially controlled. RJS

JAMES CAMPBELL NWR

Kahuku, Oahu, Hawaii

BI-ANNUAL NARRATIVE REPORT

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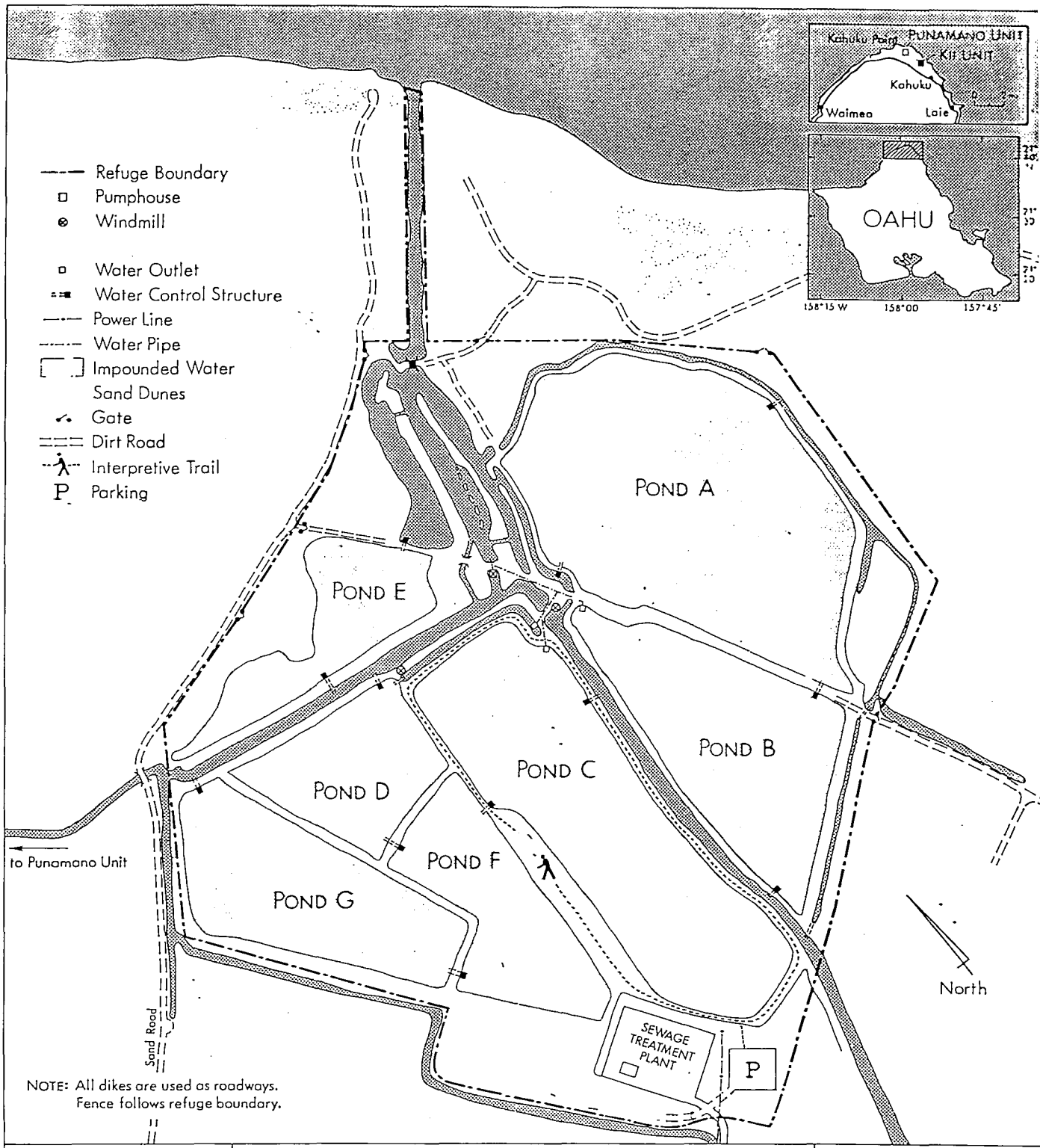
U.S. Department of the Interior
Fish and Wildlife Service
NATIONAL WILDLIFE REFUGE SYSTEM



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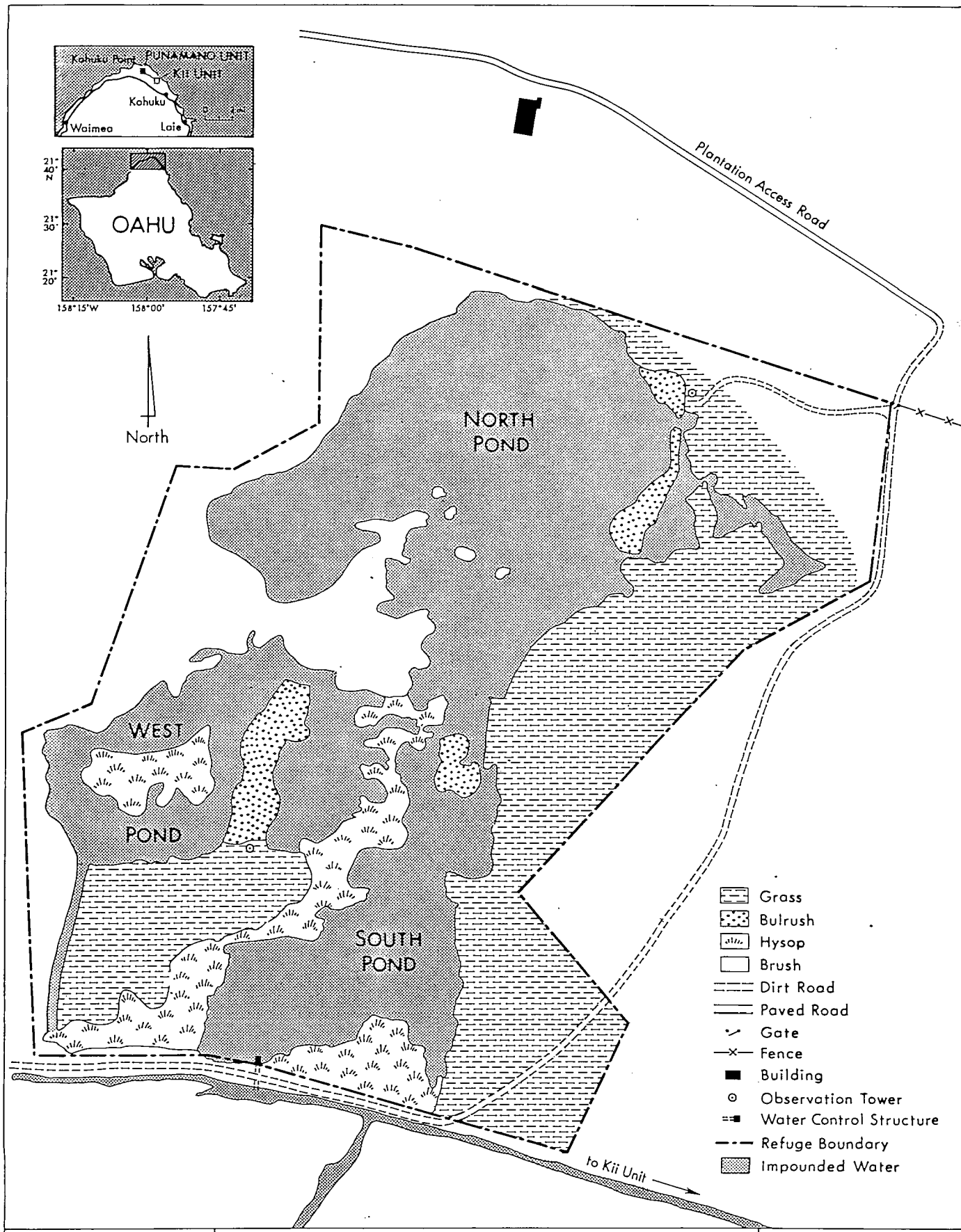
KII UNIT
JAMES CAMPBELL NATIONAL WILDLIFE REFUGE
Kahuku, Island of Oahu, Hawaii

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



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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

1983: Regional Director Myshak and the AWR evaluation team visited the refuge on 5/31/83. Teacher workshops continued on the Kii unit (Sec. E.2). BLHP projects on the Kii unit improved the wetland habitat and management (Sec. F.2). An innovative low-lift pump was installed on the Kii unit (Sec. I.1).

1984: The refuge completed a successful accident-free YCC camp (Sec. E.2). Fulvous whistling ducks were increasing on the refuge (Sec. G.3). Teacher workshops continued on the Kii unit (Sec. H.3). A new Avery-Young pump and stroke control was installed in the Kii unit (Sec. I.1). The refuge was visited by key personnel from the Washington, D.C. and regional offices (Sec. J.2).

B. CLIMATIC CONDITIONS

1983: The nearest weather recording station, Amorient Aquafarm, is located adjacent to the refuge. The following station summary for January-December, 1983, reflects the climatic conditions at the refuge.

	Average	Extremes (dates)
Temperature	75.5 F	57 (12/23); 86 (9/5)
Wind Speed	14 mph	--
Rainfall	25.88" total	.91" (Feb); 3.75" (Sept.)

Overall, it was a dry year with no major storms affecting the refuge.

1984: The following station summary for January-December, 1984, reflects the climatic conditions at the refuge.

	Average	Extremes (dates)
Temperaure	76.7 F	56 (2/5); 94 (10/8)
Rainfall	16.06" total	0" (Aug.); 9.4" (Sept.)

Overall, it was a very dry year with no major storms affecting the refuge.

C. LAND ACQUISITION

1. Fee Title

1983: There were discussions during the year of a possible land exchange between the FWS and Campbell Estate. It involved the exchange of the GSA Nike Missile Site for the leased land area of James Campbell NWR. The excess property Missile Site is located in the middle of a large tract of Campbell Estate land. However, no progress was noted by the year's end.

1984: The GSA Nike Missile Site was not discussed during the year. Campbell Estate has lost interest in this exchange.

2. Easements

1983: Shallenberger and Colemen met with Campbell Estate representatives throughout the year to discuss an addition of three items to the refuge lease agreement. The items include: (1) a right-of-entry easement across the paved roadway from Kamehameha Highway to the Wastewater Treatment Plant; (2) lease

of a 1 1/2 acre parking area adjacent to the Wastewater Treatment Plant; and (3) an addition of approximately ten acres of wetland habitat along the southern boundary of the Kii unit. At the close of the year, a draft lease agreement for items (1) and (2) was being reviewed at the FWS regional level.

A one-day easement was permitted by the Campbell Estate for entry on the paved Wastewater Treatment Plant raod on March 26, 1983. A refuge "Open House" was scheduled for that day (Sec. H.7).

1984: During the year, Shallenberger and Krakowski met with Campbell Estate representatives to discuss an addition of three items to the refuge lease agreement. The items include: (1) a right-of-entry easement across the paved roadway from Kamehameha Highway to the Wastewater Treatment Plant. Previous access was by way of Sand Road, which is on the west end of the Kii unit. This road is hardly passable during wet periods and cannot be travelled by school buses; (2) lease of a 1 1/2 acre parking area adjacent to the Wastewater Treatment Plant. Presently the Kii unit does not have parking area for visitors; and (3) a 10-acre addition of wetland habitat to the lease. This includes pond F and a portion of pond G that were not originally included in the lease.

In January of 1984, the refuge finalized the agreements for the first two items. Documents for the third item continued to be reviewed by year's end. However, the Estate did allow the refuge to build a fence on the proposed boundary in 1984.

D. PLANNING

3. Public Participation

1984: On January 12, Shallenberger, Krakowski, and Woodside met with James Campbell Estate management personnel. The Estate was informed of our present management conditions and future I&R plans. A flood drainage discussion also took place. The Estate leases land to agricultural interests south of the refuge. The Estate is still concerned that the refuge is not adequately addressing drainage during flood periods.

The Hawaii Audubon Society is proposing to adopt the Kii unit of James Campbell NWR. Discussions with board members of the Society occurred during the year to further the proposal.

5. Research and Investigations

1983: Refuge staff met with Bruner and Arume of BYU-Hawaii to discuss a Hawaiian coot nesting study at the Kii unit of James Campbell NWR. Arume agreed to check for nests one day per week

and analyze the different habitat types (Batis, dead Pluchea, Brahiaria, Paspallum) for coot nest site preference. Arume did not monitor coot chick survival, since it requires too much time. Byrd compiled all the available coot nest site records in preparation for a publication.

1984: Shallenberger, Byrd, and Krakowski met with Bruner and Arume of BYU-Hawaii to discuss a Hawaiian coot nesting study at the Kii Unit of James Campbell NWR. Arume agreed to check for nests and to analyze the different habitat types (Batis, dead Pluchea, Brachiaria, Paspallum) for coot nest site preference. Arume did not monitor coot chick survival, since it would require too much time. Byrd requested available coot nest site records in preparation for a publication in Hawaii's "Elepaio" Audubon newsletter. Arume was asked to record other bird nests observed.

E. ADMINISTRATION

1. Personnel

1983: Rick Coleman (Wetland Assistant Refuge Manager) left for a staff job in the refuge division of the FWS Washington Office on 9/2/83.

1984: Jim Krakowski, Refuge Manager (Wetlands), came on board January 8, 1984.

2. Youth Programs

1983: Six YCC enrollees participated in an eight week (June 27-August 19) non-residential camp. Their activities on the James Campbell NWR included: clearing vegetation from fencelines, repairing fence, clearing vegetation from waterbird nesting islands, and replacing refuge boundary signs.

1984: Six YCC enrollees participated in an eight week (June 11-August 3) non-residential camp. Jack Leischman was hired as crew leader for the camp and did a good job in completing projects and having an accident-free camp. Their activities on the James Campbell NWR included: clearing vegetation from fencelines, repairing fence, clearing vegetation from waterbird nesting islands, trapping mongoose and replacing refuge boundary signs.

4. Volunteer Program

1984: Two groups volunteered to clear vegetation from islands within the Kii unit. This work was donated in an effort to provide nesting habitat for stilts. The Audubon Society on

March 10 and a boy scout troop on November 10 donated their time and energy in order to provide nesting habitat for waterbirds.

Clearing islands by hand is hard work. Volunteer efforts are greatly appreciated by refuge staff. JK

F. HABITAT MANAGEMENT

1. General

This 141.5-acre refuge consists of approximately 74 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 maritima*, 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 *Ruppia maritima*, *Bacopa monnieri*, and *Pluchea indica*.

The 104.5-acre Kii unit is surrounded by a livestock fence, while the 37.5-acre Punamano unit remains unfenced.

2. Wetlands

1983: Management within the Kii unit during 1983 and 1984 consisted of maintaining water levels within ponds A, B, C, and D by pumping water out of the main drainage canals. A five-horse power electric pump along with one low-lift wind generated pump moved water to the ponds in 1983. To add to the refuge's management capabilities and reduce electrical costs, an innovative fiberglass low-lift pump was added to the 12-foot aeromotor windmill (Sec. I.1) in 1983. This replaces a six inch metal pump and doubled the pumping capacity. Some of the nesting islands within the Kii unit were cleared early in the year to provide stilt nesting habitat. Mechanical and herbicide (Sec. F.10) control is used to set back the *Pluchea* and *Batis*. Coleman experimented by covering several islands with surplus canvas army tents over long periods of time to kill vegetation. The covering did kill the vegetation, however, the canvas quickly decomposed in the sun and water.

With the help of BLHP funds, the refuge expanded the wetland area of the Kii unit. A contract for heavy equipment rental was issued to Ron's Construction of Oahu. Ponds C and F were further excavated to a depth of 3.5 feet above msl. Excavation material was used to shore up dikes around ponds C, F, G, and D. Nesting islands were also constructed within ponds C and F. Five new water control structures (metal culvert with flash board riser) were installed within dikes of ponds C, F, G, and D.

1984: To add to the Kii unit's management capabilities and reduce electrical costs, the refuge added a 14-foot Fiasa windmill and an additional Avery fiberglass pump. The Kii unit now has two windmill powered pumps, one on a 12-foot mill and another on a 14-foot mill (Sec. I.1).

The refuge pumped water into ponds F and G for the first time in 1984. There was seepage through the dikes of these ponds and a great deal of pumping was required to fill them. By year's end, ponds F and G were almost full.

Again in 1984, nesting islands within the Kii unit were cleared early. Selected islands in ponds A, B, and C were hand-cleared by volunteers. Mechanical and herbicide control (Sec. F.10) is used to set back the *Pluchea* and *Batis* on other islands in ponds A, B, C, F, and G.

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.

10. Pest Control

1983: Vegetation control of Brachiaria sp. 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. A 2% solution had good results. Banvel herbicide was used to control Batis sp. vegetation in Kii unit nesting islands.

The dikes separating the Kii ponds serve as refuge roads. Brachiaria sp. on these roads must be mowed every couple of weeks in order to pass with a vehicle. The dike along pond C was sprigged with bermuda grass in order to establish a more desirable species.

1984 Control of Brachiaria sp. continued as in 1983.

Bermuda grass, sprigged in 1983 along the top of the makai (North) portion of the dike surrounding pond C, was holding its own by the end of the year.

Mongoose control is covered under Sec. G.15.

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, particularly the stilt, numerous other migratory bird species used these same improved areas. This immediate wildlife response clearly indicates the great potential for wildlife diversity at the Kii unit when it reaches full development.

2. Endangered and/or Threatened Species

All four endangered Hawaiian waterbirds (Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck) nest and maintain populations on both units of James Campbell NWR. The Kii unit contains higher numbers of these birds normally, an exception may be the moorhen. Census data more often comes from the Kii unit, because most of the maintenance projects are located there.

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

1983: Kii stilt numbers ranged from 70-130 with a peak of 137 recorded in November. Coots ranged from 190-320 with a peak of 352 in January. The moorhen is a difficult bird to observe and normally 2-4 are censused on the Kii unit. The Hawaiian duck ranged from 8-14 birds during the year.

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. The sightings were reported to George Balazs of the National Marine Fisheries Service. This is the second year that these turtles have nested in this location, which is the only recorded green turtle nesting area on Oahu.

FWS and Hawaii DLNR personnel captured 17 Hawaiian coots (10/14) at the Kii unit of James Campbell NWR and 11 Hawaiian moorhens at the Haleiwa, Oahu, hasu fields (5/9). Tracheal and cloacal swabs, blood smears, and body weights were taken from all birds. The coots were banded, neck collared and released at trap sites. Six of the moorhens were banded, neck collared, and released at the Kakahaia NWR on Molokai during the month of May.

1984: Kii stilt numbers ranged from 40-90 with a peak of 113 recorded in November. Coots ranged from 90-150 with a peak of 233 in October. Numbers of stilt and coot have decreased from last year, possibly due to the increased operation of Amorient Aquafarm. The prawn farm provides very good maintenance habitat,

i.e. food, cover, loafing, for the waterbirds. Nesting records were few in 1984; possibly a dry year had some effect on the birds.

The moorhen is a difficult bird to census and usually only 2-8 are recorded on the Kii unit. The Hawaiian duck population ranged from 8-15 birds with a peak of 32 ducks observed on 11/16.

During the month of July, several green sea turtles (Chelonia mydas) nested on the beach adjacent to the Kii unit of the refuge. The sightings were reported to George Balazs of the National Marine Fisheries Service. This is the third year that green turtles have nested in this location.

Refuge staff participated in the State of Hawaii's semiannual waterbird count by censusing the refuge on 1/10 and 8/1.

3. Waterfowl

1983: Wintering and migratory waterfowl use the refuge September through April. Northern shovelers and pintails are the most numerous, numbering 100-300 birds on the Kii unit. Other ducks observed include wigeon, green-winged teal, fulvous whistling duck, mallard, and scaup.

1984: Wintering and migratory waterfowl use the refuge September through April. Northern shovelers and pintails are the most numerous, numbering 100-300 (70-230 shovelers and 30-70 pintails) on the Kii unit.

Other ducks observed include wigeon, blue-winged and green-winged teal, garganey, fulvous whistling duck, mallard, and scaup. Fulvous whistling ducks were observed at James Campbell NWR throughout both years. This bird was first observed in the wild on Oahu in 1979. During the early 1980's, their numbers ranged from 2-6. The species can now be seen on a regular basis in the Kahuku area. On 11/30/84, Krakowski observed 13 fulvous whistling ducks flying over the Kii unit. This was the highest count of fledged whistling ducks on Oahu to date. The refuge is faced with the predicament of how to treat these birds. We are not positive of their origin, however, the whistling duck is a popular breed with some of the local aviarists and probably our local population is derived from that stock. Now these feral birds are starting to breed and their numbers seem to be doubling with each year. The whistling duck population may increase to the point where they may be in direct competition with the native Hawaiian duck for food, cover, nesting sites, etc. Our philosophy for maintaining competitive species is as follows: birds reaching the islands under their own power are considered native and thus if a bird reaches these islands under its own power and becomes established, we should have no qualms about it, since that is the natural way. Whenever an introduced species (brought in by Man vs. natural means) is a threat to a population of endangered birds, we must analyze the problem and decide if

appropriate control measures are necessary. Presently, the FWS is trying to ascertain the origin of these birds and any possible competition between this bird and our native species.

One to eight mallards were observed during both years at the Kii unit. These birds were observed throughout each year and are resident species. There are other mallards that migrate to the Hawaiian Islands for the winter months. Biologists believe that these resident mallards are feral. There is a concern that their numbers will increase and threaten the Hawaiian duck population. The mallards are hybridizing with the Hawaiian duck and threatening the integrity of the species. Several hybrid duck nests were found during both years.

The deeper natural pond at the Punamano unit continued to support the greatest statewide concentration of wintering lesser scaup with 30-40 birds.

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 Waterbirds

The black-crowned night heron population continues to increase in the refuge area. In 1983 and 1984, the refuge population ranged from 50-70 birds, which is approximately the same as last year. However, the adjacent Amorient Aquafarm population is increasing. There is a concern that the night heron may be preying upon endangered waterbird eggs and young.

During both years, the cattle egret population ranged from 14-30 birds observed on the refuge. However, the refuge 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 waerbirds as predators or vectors of avian disease.

Black-crowned night herons (auku'u) lining up for a prawn dinner at Amorient. When they take mature prawns that sell for $6.50/lb., it can mean severe consequences for a business. RJS

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 were equally attractive to most migratory shorebirds.

1983: The most common shorebird species included: American golden plover (20-80 birds), ruddy turnstone (10-200), sanderling (5-100), and wandering tattler (4-7). Other incidental shorebirds included: long-billed dowitcher, pectoral sandpiper, Biard's sandpiper, semi-palmated plover, lesser yellowlegs, and Wilson's phalarope (all less than 10 birds).

On rare occasions, a gull is observed on the refuge. During the month of January, 1983, a lone Bonaparte's gull was regularly seen on the Kii unit.

1984: The most common shorebird species included: American golden plover (20-30 birds), ruddy turnstone (10-60), sanderling (5-50), and wandering tattler (4-9). Other incidental shorebirds included: long-billed dowitcher, pectoral sandpiper, Baird's sandpiper, semi-palmated plover, common snipe, lesser yellowlegs, and Wilson's phalarope (all less than 10 birds).

Glaucous-winged, Bonaparte's, and laughing gulls were occasionally noted on the Kii unit.

On rare occasions, great frigatebirds may be seen swooping down on the refuge to get a drink of fresh water.

During the winter of 1983-1984, 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. We believe that these are young birds that may be prospecting for nesting areas for the next season. There are no nesting records of Laysan albatross nesting on Oahu although many years ago they did nest on Moku Manu off of Kaneohe. 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 refuge.

6. Raptors

Short-eared owls and barn owls were often seen during both years over the grassy areas of the Kii unit. The short-eared owl, or Pue'o, probably nested on the refuge, although no nests were actually located.
In 1984, a peregrine falcon was observed on the refuge during the months of November and December.

10. Other Resident Wildlife

During both years, approximately 5-10 ring-necked pheasants reside on the refuge. In the past, local hunters have crossed refuge boundaries in search of these birds.

15. Animal Control

Live traps were occasionally set out during the spring and early summer months during 1983 and 1984 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. Forty-five trap nights captured 45 mongoose and one cat between 2/7/83 and 2/9/83 and represents a typical catch after not having trapped for six months.

H. PUBLIC USE

1. General

Public use of James Campbell NWR during 1983 and 1984 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 outdoor classroom use by teachers trained at a special workshop conducted by the refuge staff.

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 use of one portion of the unit will result in minimal disturbance to the waterbirds.

2. Outdoor Classrooms - Students

The Kii unit was used by 2 school groups during each 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.

3. Outdoor Classrooms - Teachers

The refuge is actively trying to promote the use of the Kii unit as an outdoor classroom for Oahu teachers. Each year the refuge conducts workshops, where teachers can learn about the refuge and its management. If they desire an unaccompanied tour, teachers cannot bring their class to the refuge without first going through the workshop.

On August 2, 1983, one teacher workshop was held at the Kii unit. Eighty-four teachers attended.

In 1984, two teacher workshops were held at the Kii unit. One was held in January and the other in August. Eighty-four teachers attended.

Local Brigham Young University instructor Phil Bruner conducts one portion of a teacher workshop at the Kii unit. JK

6. Interpretive Exhibits/Demonstrations

In 1984, Dick Kuehner, Regional Office I&R Specialist, met with the refuge to discuss I&R plans for James Campbell NWR. Plans included: entrance signs, interpretive exhibits, boardwalks, kiosks, and tour routes. Considerable review of refuge I&R plans occurred during the year.

7. Other Interpretive Programs

A public "Open House" was held at the Kii unit on 3/26/83 between noon and 4 p.m. Approximately 70 people visited the site and joined 30-minute conducted tours by Shallenberger and Coleman.

Campbell Estate trustee McVay attended the program.

Coleman gave a Kii unit tour to the Secretary General and two other officials of the Japanese Association of the Preservation of Birds on 4/7/83.

11. Wildlife Observation-

1983: Groups from Foster Gardens, the Audubon Society, and the Sierra Club toured the Kii unit of the refuge.

1984: Groups from the Department of Education, Audubon society, Nature groups from Canada, and the University of Hawaii visited the Kii unit of the refuge during the year.

17. Law Enforcement

1983: Four males were caught using a seine net in the main canal at the Kii unit on 1/1/83. They were observed by Special Agent Bartee who later apprehended the four with over 50 pounds of fish

and prawns in their possession. Each was fined $25 for trespass and $25 for illegal fishing. All four paid their fines.

1984: An occasional weekend problem is the trespass of fishermen on the Kii unit. Most times they are attempting to catch baitfish at the outlet structure. Those apprehended were advised of the refuge objectives and the rationale for not allowing trespass on the refuge. No citations were issued.

During the month of March, 1984, we had some problems with a few head of cattle getting into the Kii unit after a portion of the east fence was broken or cut. Cattle were removed as soon as the event was observed by our adjacent grazer.

I. EQUIPMENT AND FACILITIES

1. New Construction

1983: Ron's Construction of Oahu was contracted through BLHP funding to do major construction work on the Kii unit of James Campbell NWR. Throughout the spring and summer months, work progressed on the following projects: (1) Excavation of ponds C and F to an average elevation of 3.5 feet above msl. Excavated fill material was used to shore up dikes along ponds C, D, and F; (2) nesting islands were pushed up in ponds A, C, and F; (3) Four additional water control structures (metal culvert with flash board riser) were placed; and (4) two 90-degree bends in the Kii ditch south of the refuge were straightened to improve flood water drainage.

Regional office engineering staff (Striplin, McVein, Poe) visited the refuge several times during 1983 to coordinate the ongoing BLHP projects.

Don Avery, retired University of Hawaii Professor of Engineering, was contracted to provide a replacement pump for the 12-foot Aeromotor windmill at the Kii unit. He has developed an innovative low-lift two-stroke fiberglass pump that can be adapted for use by a windmill. The pump was installed during the summer of 1983 and has provided additional water to ponds B and C. The 13.3" X 15" fiberglass pump can lift (3 feet) water at a rate of 425 gpm in a 13 mph wind.

A 12-foot aeromotor windmill ran the fiberglass low-lift pump, which is located at the end of the hospital drain. RJS

1984: Ron's Construction of Oahu was contracted through BLHP funding to construct the concrete base and inlet culvert for the 14-foot windmill tower at the Kii unit. This windmill stands on the dike between ponds D and F close to the Punamano ditch.

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. Thier 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. In 1984, the Avery-Young "pump D" was added to the newly erected 14 feet Fiasa windmill. The windmill went into action on July 20. this pump has an additional feature, a stroke control that changes the length of stroke with the change in wind velocity. This 18" by 24" fiberglass pump can move 850 gallons per minute with three feet of head in a 13 mph wind. They discovered that the Fiasa gearbox was not lined up properly and mill friction in rotation affected output. They believe that with a realignment of gears and bearing replacement of washers the pump/mill could product 1200 gpm in a 13 mph wind. Avery and Young continued to work out bugs in the windmill and pump by year's end.

The 14-foot Fiasa windmill with stroke control. JK

The 14-foot windmill drives this two-stroke Avery/Young pump. JK

Regional Office enginerring staff (Striplin and McVein) visited the refuge several times during 1984 to coordinate the ongoing BLHP projects.

In 1984, Woodside installed a 24" culvert with flash board riser between ponds A and B.

2,250 feet of barbed and hog wire were added to the south boundary of the Kii unit.

3. Major Maintenance

In 1984, a heavy rain storm caused the transformer to blow out in the 40 hp. pump house. The pump was out of commission for one day as a result. Power surges during the storm may have caused the blowout, however, the transformer should have built-in safeguards to prevent this. The power company and Regional Office engineering were consulted and a new transformer was installed.

4. Equipment Utilization and Replacement

1983: In March, two cylinders on the John Deere tractor were replaced with the help of Amorient Aquafarm.

1984: A model M5 Woods mower was purchased for the Ford 1700 tractor.

6. Energy Conservation

1983: The success of the Avery pump has kindled the desire to install more wind driven pumps to move water. Constant trade winds of 10-18 mph make the Kii site an ideal one.

J. OTHER ITEMS

2. Items of Interest

1984: Don Knowles, staff member of the Interior Subcommittee of Senate Appropriations, visited the refuge on 2/11.

Legislative aides Chris Dawson (Senator Evans, WA) and Craig Zamuda (Senator Breaux, LA) visited the refuge on 5/25.

Jim Leupold, FWS-WO-Budget Officer, visited the refuge on 6/20.

Regional Director Myshak visited the refuge on 10/12.

Bob Gilmore, Assoicate Director AFA-WO, and Paul Carothers (staff of Senator Breaux, LA) visited the refuge on 11/26.

PEARL HARBOR NWR

Honolulu, Hawaii

BI-ANNUAL NARRATIVE REPORT

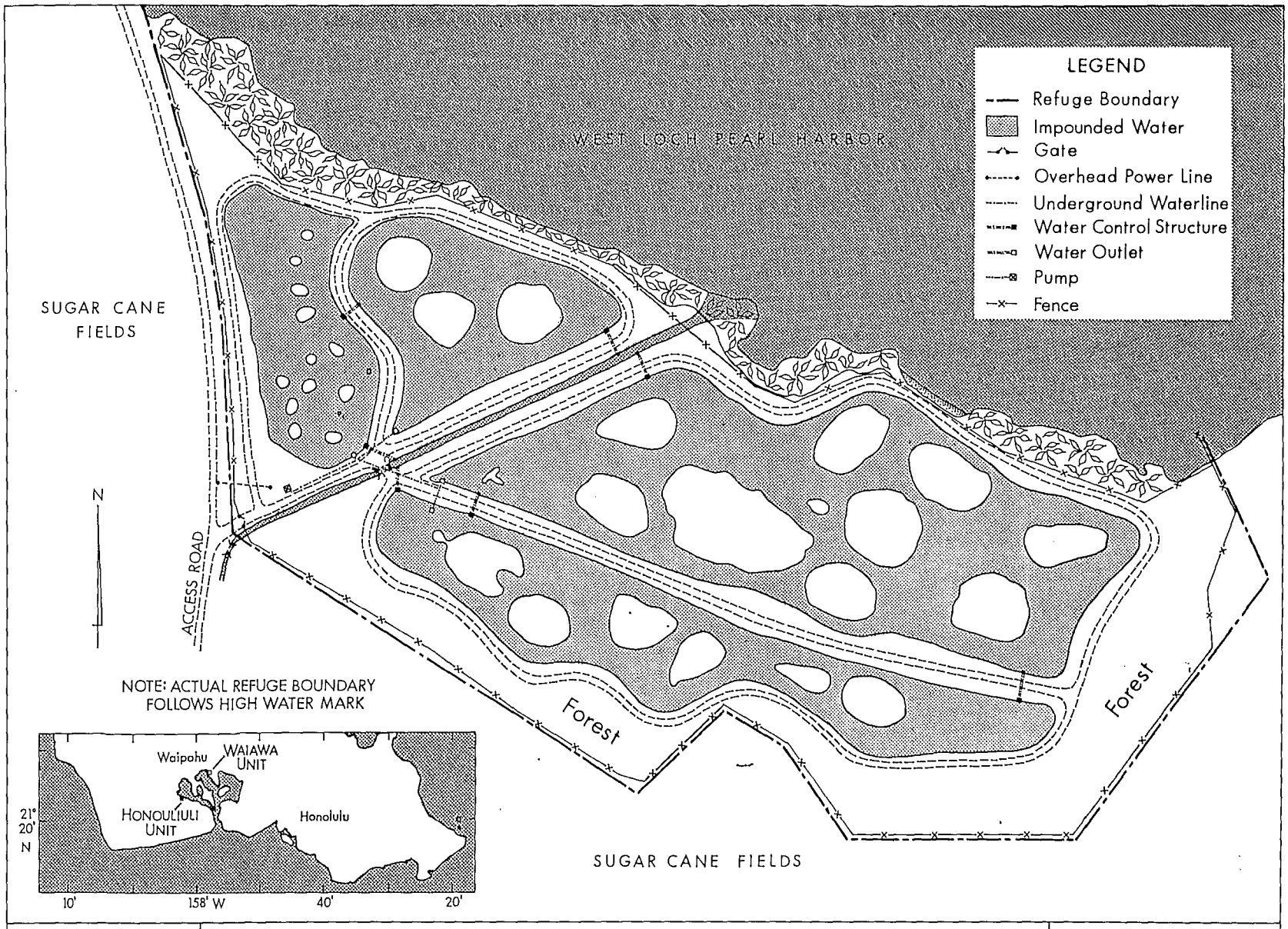
Calendar Years 1983 and 1984

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. Low dikes retain shallow water impoundments on each unit. Pumps provide water for each of the ponds. The Pearl Harbor refuge habitats were constructed to partially mitigate losses sustained to natural habitat that was destroyed during the construction of the reef runway at Honolulu International Airport. The refuge is managed by the U.S. Fish and Wildlife Service under a use 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 other side of the refuge. RWR staff



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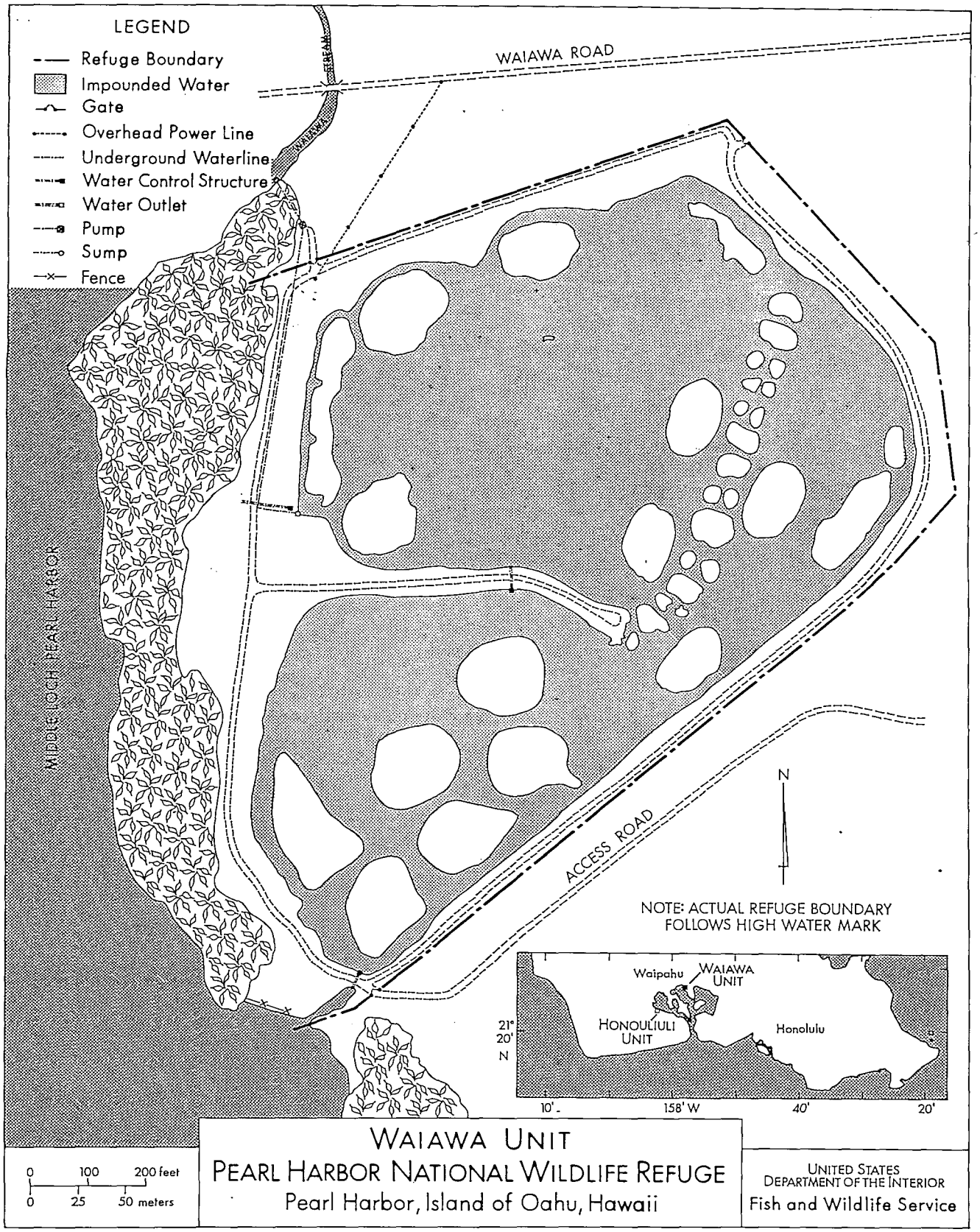
HONOULIULI UNIT PEARL HARBOR NATIONAL WILDLIFE REFUGE

Pearl Harbor, Island of Oahu, Hawaii

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service


LEGEND
Refuge Boundary
Impounded Water
Gate
Overhead Power Line
Underground Waterline
Water Control Structure
Water Outlet
Pump
Sump
Fence
WAIAWA ROAD
WAIAWA STREAM
MIDDLE LOCH PEARL HARBOR
ACCESS ROAD
N
NOTE: ACTUAL REFUGE BOUNDARY FOLLOWS HIGH WATER MARK
Waipahu
WAIAWA UNIT
HONOULIULI UNIT
Honolulu
21° 20' N
10'
158' W
40'
20'
0 100 200 feet
0 25 50 meters
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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A. HIGHLIGHTS

In 1983 an annual high of 180 stilts (11/3/83) and 125 coots (7/11/83) were observed on the Honouliuli unit (Sec. G.2). A white-faced ibis was observed on the refuge throughout the year (Sec. G.4). Results from water samples of the Waiawa Unit were received (Sec. J.1).

In 1984 the refuge successfully completed an accident-free non-residential YCC camp (Sec. E.2). A major contract was awarded to Trees of Hawaii to clear vegetation from the fenceline of the Honouliuli Unit (Sec. F.3). A white-faced ibis, a very rare sighting in Hawaii, was recorded on the Honouliuli Unit during the year (Sec. G.4).

B. CLIMATIC CONDITIONS

1983: 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, 1983, reflects the climatic conditions at the refuge:

	Average	Extremes (dates)
Temperature	74.6 F	91 (9/18), 53 (12/20)
Rainfall	5.29" total	.12" (July), 1.41" (Dec.)

1984: The following station summary for January-December, 1984, reflects the climatic conditions at the refuge:

	Average	Extremes (dates)
Temperature	76.0 F	56 (2/5), 94 (10/8)
Rainfall	16.06" total	0" (July), 9.4" (Dec.)

C. LAND ACQUISITION

3. Other

Both units of the refuge, Waiawa unit (24.5 acres) and the Honouliuli unit (36.5 acres), are perpetual easements from the U.S. Department of the Navy. These easements were obtained in

1976. An additional 14-acre parcel, hereafter called the Waiawa Annex unit, was offered to the Service by the Navy in 1979. This unit, located approximately one-half mile south of the Waiawa unit on the same peninsula, contains a deep coastal fish pond overgrown with a dense stand of mangrove trees. The Service determined that the Waiawa Annex would require high initial development, and would produce only marginal habitat for endangered waterbirds. The City and County of Honolulu expressed an interest in a portion of the Waiawa Annex land as part of a municipal golf course. Cooperative development plans for this site, initiated in 1980, were postponed throughout 1983-1984.

On November 20, 1984, FWS personnel Krakowski, Woodside and Herbst, along with U.S. Navy Resource personnel Burr and Egelund, toured the Pearl Harbor area to discuss military lands that need to be protected for endangered waterbirds. Herbst participated in the survey to check for endangered plants. The group looked at the Waiawa Annex, which is being further encroached by mangrove. Again it was determined that the FWS is not interested in adding this unit to the Pearl Harbor NWR at this time. However, important waterbird areas were located on the Waipio Peninsula and on City property north of the Peninsula. The group made plans to try to protect the areas if present conditions change and the need or opportunity to acquire them presents itself.

D. PLANNING

5. Research and Investigations

1984: Hawaii's Oceanic Institute has been conducting studies on the propagation of milkfish and mullet for Third World countries. David Crear of AECOS, 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 Mr. Crear permission to collect fish from the Waiawa Unit starting in 1982. In addition, he planned to collect milkfish and mullet each year to monitor fish growth in the refuge. In 1984, Mr. Crear was conducting studies in Saudi Arabia and did not sample the Waiawa unit.

E. ADMINISTRATION

1. Personnel

1984: Jim Krakowski, the new Refuge Manager (Wetlands), started on January 8.

2. Youth Programs

1983: Six YCC enrollees participated in an eight week (June 27-August 19) 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.

1984: Six YCC enrollees participated in an eight week (June 11-August 3) non-residential camp. Their activities on the Pearl Harbor NWR included: clearing vegetation from fencelines, repairing fence, clearing unwanted vegetation from waterbird nesting islands, trapping mongooses, pulling mangroves from drainage canals and replacing boundary signs.

F. HABITAT MANAGEMENT

1. General

This 61-acre refuge consists primarily of shallow man-made impoundments at two units 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. Water levels in the individual impoundments are maintained artificially by electric pumps.

2. Wetlands

The intensive habitat management efforts at both units of the Pearl Harbor NWR have been reasonably successful. Due to the small size of these man-made habitats, disturbance by man and predators such as feral dogs, cats, and mongooses appears to be the major limiting factor in achieving the maximum use by the endangered waterbirds.

The Waiawa Unit has had a problem with extremely high salinities. High tides bring Pearl Harbor sea water into the refuge. Salinities increase as evaporation reduces the amount of fresh water and concentrates the salts. The Service plans to reduce the salinity by rehabing the water intake system.

The Waiawa unit also has an overabundance of tilapia. This alien fish reduces the unit's food supply for the endangered waterbirds. Native milkfish and mullet are also present, but do not pose a threat to the waterbirds. They are not as numerous as the tilapia and have a selective diet. A replacement fish grid was installed at the outlet, in an effort to keep large breeding tilapia out and a population of milkfish in.

Roadways at both units were mowed and cleared of invading trees and shurbs. Scirpus maritimus was burned along the shoreline of pond 4 of the Honouliuli unit using a drip torch.

1983: In an effort to save utility costs, pump hours at both units were reduced to 4 hours per day.

During the month of June, the menzi muck was contracted for use at the Waiawa unit. The machine excavated portions of the perimeter moat and broke up the road dividing Waiawa's two ponds.

The Menzi Muck in action. It travels by pulling itself with an extended bucket. RWR staff

1984: Two five-horse power electric pumps deliver water to both units of the refuge. The Waiawa pump draws water from the Waiawa stream. The Honouliuli pump draws water from a well. 1984 was a dry year and, as a result, pumping costs were considerably higher.

The Waiawa Unit has had a problem with extremely high salinities. High tides bring Pearl Harbor sea water into the refuge. Salinities increase as evaporation reduces the amount of fresh water and concentrates the salts.

Early in the year, a crack in the water inlet pipe at the Honouliuli unit reduced the flow of water to pond 2. The dry year further reduced the water level in this pond. The pipe was repaired in November.

Roadways at both units were mowed and cleared of any trees and shrubs to facilitate vehicle passage.

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.

1984: Trees of Hawaii was awarded a contract to clear the fenceline around the Honouliuli unit. They completed the project during the summer months for $4500.

10. Pest Control

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

G. WILDLIFE

1. Wildlife Diversity

This refuge was established as mitigation for the loss of stilt feeding habitat when the Keehi Lagoon reef runway of Honolulu International Airport was built in 1976. As a result, the man-made wetland habitats of this refuge were designed to provide feeding and nesting areas 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 1984.

2. Endangered and/or Threatened Species

1983: The fresh water habitat at the Honouliuli unit was used by all four of Hawaii's endangered waterbirds; the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. High numbers of stilt populations were observed during the fall of 1983 at this unit. Counts of 165 in October and 180 in November were far above the normal 30-40 birds. Coot numbers were also high at the

Honouliuli unit during the summer months. Counts of 80 and 125 were far above the normal 15-40 birds. Moorhen sightings ranged from 2-6 during the year, mostly in pond 1. The Hawaiian duck was only sighted occasionally with numbers ranging from 2-4.

A congregation of stilts at the Honouliuli unit. RJS

The Waiawa unit also had fair numbers of three of the endangered waterbirds. Coot numbers increased dramatically from populations of 15-25 through June to a July population of 60 that gradually grew to 94 at the end of the year. Stilt numbers varied little throughout the year (5-20 birds) with a peak population of 28 in April. Hawaiian ducks were only occasionally sighted, with numbers ranging from 1-2.

1984: The fresh water habitat at the Honouliuli unit was used by all four of Hawaii's endangered waterbirds; the Hawaiian stilt, Hawaiian coot, Hawaiian moorhen, and Hawaiian duck. Stilt numbers on the unit are highly variable. Normally 20-40 can be observed, however, counts of 123 (4/13) and 250 (11/7) have been recorded. Coot numbers did not vary as much and ranged from 8-15 with a peak of 28 on 2/20. A pair of Hawaiian moorhen can usually be seen in pond 1. One coot chick was observed on the unit on 5/24.

The Waiawa unit also had fair numbers of three of the endangered waterbirds. Coot numbers ranged from 25-46 January through June. Then the population dropped dramatically to zero for the last 3 months of the year. Stilt numbers ranged from 5-22, with a peak of 33 on 4/3. Occasionally, one or two Hawaiian ducks were

observed on the unit. The drop in coot numbers may be attributed to the increase in the fish population, especially the tilapia. It is believed that their high numbers may be reducing the flora and fauna of the unit.

Counts on these units can be variable due to conditions on and off the refuge. Waterbirds may be drawn to the Waipio Peninsula or other areas if wet weather creates more habitat.

3. Waterfowl

1983 : Wintering and migrating waterfowl use both units of the refuge during the spring, fall, and winter months. Observations at the Honouliuli unit include: 30-50 northern shoveler, 12-15 pintail, 7 American wigeon, 2-3 ring-neck, and 1 scaup.

Observations at the Waiawa unit include: 2-8 northern shoveler and 1 mallard.

1984: Wintering and migrating waterfowl use both units of the refuge during the spring, fall, and winter months. Observations at the Honouliuli unit include: 6-33 northern shoveler, 12-45 pintail, 7 American wigeon, 2-4 mallards; and 1 teal.

Observations at the Waiawa unit include: 2 northern shoveler and 1 mallard.

4. Marsh and Waterbirds

The native black-crowned night heron was commonly seen in both units of the refuge. The average heron population numbered less than ten per 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.

A white-faced ibis was observed at irregular intervals at the Honouliuli unit during 1983 and 1984. This ibis was also seen at regular intervals on the Waipio peninsula, located between both units of the refuge. This is a very unusual sighting for the Hawaiian Islands.

This white-faced ibis is a long way from its normal breeding grounds. RWR staff

1983: Cattle egrets numbering 2-6 were also observed on the Honouliuli unit during the year.

1984: Cattle egrets numbering 2-15 were also observed on the Honouliuli unit during the year. The Waiawa unit also reported 1-3 cattle egrets.

5. Shorebirds, Gulls, Terns, and Allied Species

1983: Migratory shorebirds observed at the Honouliuli unit include: American golden plover, averaging 20-40, with a peak of 80 on 10/1/83; ruddy turnstone 3-8; and tattler 2-5.

The Waiawa unit contains more shorebird habitat and had the following observations: American golden plover (15-40) with a peak of 60 on 11/12/83; ruddy turnstone (15-25); wandering tattler (2-5); and sanderling (5-15). Sightings of these birds occur normally only during the fall, winter, and spring months.

1984: Migratory shorebirds observed at the Honouliuli unit include: American golden plover, averaging 20-60 with a peak of 156 on 8/22; ruddy turnstone 3-81; and tattler 2-5.

The Waiawa unit contains more shorebire habitat and had the following observations: American golden plover (10-60) with a peak of 80 on 8/22; ruddy turnstone (15-25); wandering tattler

(2-5); and sanderling (5-15). Sightings of these birds occur normally only during the fall, winter, and spring months.

11. Fisheries Resources

1983: Adult milkfish were collected in Waiawa unit during the month of March for Hawaii Oceanic Institute's research on captive propagation of this species. The milkfish collected were compared with data from fish collected the previous year in the same unit. Fish collected in 1983 were smaller than those collected in 1982. It was concluded that the original 4-year old population in the unit no longer existed in the ponds and the 1983 fish were recent immigrants from Pearl Harbor. The fry of this species, as well as mullet, are free to enter the refuge through the screened outlet to the harbor.

1984: The Waiawa unit contained an overabundance of tilapia, mullet, and milkfish. No submergent aquatic vegetation could be seen growing in the pond and the fish are believed to be responsible. Large fish will be removed in 1985, as the refuge drains the unit to facilitate a construction project.

15. Animal Control

Live traps were occasionally set out during the spring and early 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.

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 will deter such activity in the immediate future.

1984: Dick Kuehner, Regional I&R Specialist, visited the refuge on 1/24. Plans for an entrance sign, interpretive signs, and school use of the refuge were discussed.

The mongoose was imported to Hawaii during the 1880's to control rats in sugar cane fields. However, the rat is nocturnal and the mongoose is diurnal. Now Hawaii has an additional problem animal. RWR staff

2. Outdoor Classrooms - Students

1984: Refuge staff met with John Hawkins of the Hawaii Department of Education to discuss teacher and student use of the refuge. Although Campbell NWR is our choice to fulfill I&R goals, a closer site would be more suitable to their needs. Future use of the Pearl Harbor NWR would be limited due to its small size.

11. Wildlife Observation

Two individual bird watchers received permits to visit the refuge throughout 1983-1984, totalling less than 50 hours of use per year. Their wildlife 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

repeatedly repaired. The Waiawa unit is only 25 acres in size, therefore tresspass cannot be tolerated. We've never encountered the people, and extra posting has not stopped the fishermen. Hopefully, we will meet these offenders someday.

I. EQUIPMENT AND FACILITIES

3. Major Maintenance

1983: The two electric pumps that provide water for the two units of the refuge were periodically lubricated and serviced during the year.

1984: The two electric pumps that provide water for the two units of the refuge were periodically lubricated and serviced during the year.

The valve and a cracked pipe in the Honouliuli unit that caused a lack of water in pond 2 were repaired by Woodside during the month of November.

4. Equipment Utilization and Replacement

1984: The John Deere 302 tractor, which was stored at Kilauea Point NWR, was moved to the Pearl Harbor NWR. There were no facilities on the Point to keep the tractor out of the sea breezes and as a result, corrosion set in and the tractor was in poor condition. Woodside indicated that he could rehab the machine and store it away from the marine elements within the Navy storage yard located adjacent to the Waiawa unit. Rehab of the tractor continued into 1985.

J. OTHER ITEMS

1. Cooperative Programs

1983: The refuge received the results of a water and sediment sample analysis of the Waiawa unit of Pearl Harbor NWR. The analysis for inorganic and organic substances was conducted by Ecology and Environment, Inc. for the Environmental Protection Agency. No organic compounds were detected. They sampled for: chloroform, methylene, phenol, pentachlorophenol, naphthalene, bis (2-ethylhexyl) phthalate, flouranthene, diethyl phthalate, di-nbutyl phthalate, pyrene, phenanthrene, benzoflouroanthene, benzo(a)pyrene, chlordane, pp'DDE, pp'DDD, and pp'DDT.

The following inorganic compounds were sampled:

	mg/l
aluminum	2000
chromium	14
barium	ND
beryllium	ND
cadmium	0.8
cobalt	10
copper	7.5
iron	6800
lead	14
nickel	16
manganese	440
zinc	21
boron	32
sulfide	56

Compounds not detected were: vanadium, arsenic, antimony, selenium, thallium, mercury, tin, silver, ammonia, and cyanide.

No evidence of leachate entering the refuge was found. Environmental conditions were similar to other areas sampled in Hawaii. The study, however, recommended continued sampling.

1984: The refuge is fortunate to be able to use a portion of the U.S. Navy motorpool area for storage. The area is located adjacent to the Waiawa unit. The JD 302 tractor, with its implements are stored in this secure location. They also provide us with some additional enclosed storage for fencing and other hardware materials.

KAKAHAIA NWR

Molokai, Hawaii

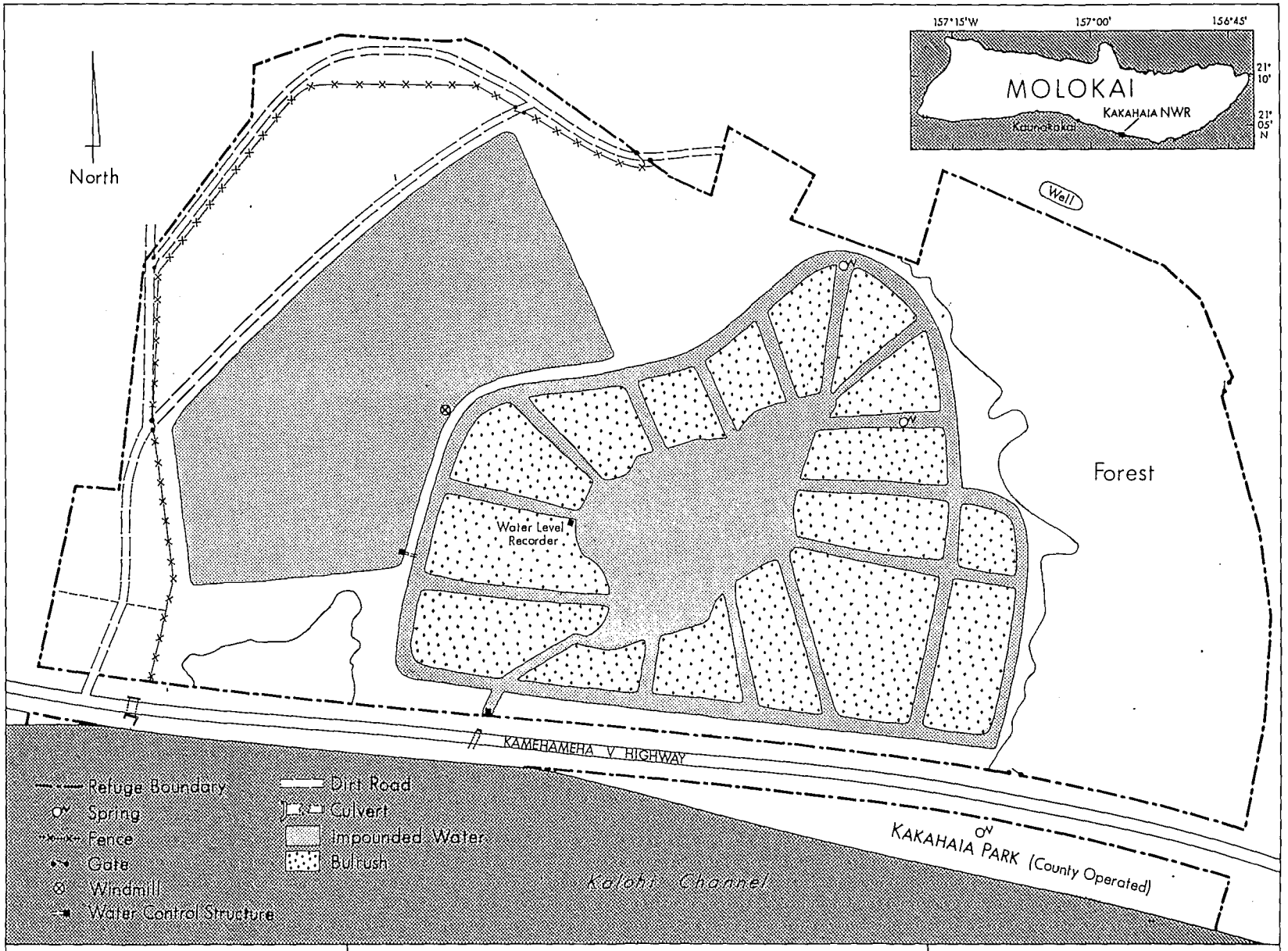
BI-ANNUAL NARRATIVE REPORT

Calendar Years 1983 and 1984

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, which is surrounded by kiawe woodlands. This 44.6 acre refuge is situated along the south coast of the island of Molokai, Hawaii, 5 miles east of Kaunakakai. The refuge was established in 1976 to provide habitat for the endangered coot. Two acres of the refuge, seaward of State Route 450, are under Special Use Permit to the County of Maui for use as a county park.



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KAKAHAIA NATIONAL WILDLIFE REFUGE

Island of Molokai, Hawaii

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

KAKAHAIA NATIONAL WILDLIFE REFUGE

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A. HIGHLIGHTS

1983: Major construction work was accomplished at Kakahaia NWR during 1983. The refuge channelized the main pond and constructed a 5.5 acre new impoundment (Sec. I.3). Six moorhen were transplanted to the refuge from Oahu (Sec. G.2).

1984: The 1983 BLHP project produces upland vegetation in the wetlands (Sec. F.2). However, the endangered species population increases as a result of this project (Sec. G.2). Vili Oto awarded contract to clear fenceline (Sec. 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, would 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 that reported for Honolulu Weather Observation Station.

1983 and 1984 were dry years. The refuge is fortunate to have a good water source that can compete with Molokai's high evaporation rates.

C. LAND ACQUISITION

1. Fee Title

1983: One parcel of private property on the north side of the refuge is surrounded by refuge land on three sides. This parcel belongs to the heirs of Sadakara. The property is located close to one of the refuge's main water springs and less than 50 feet from the wetland. Presently it is unoccupied, however, this may not be the case for very long. Owners and realtors are showing property in this area.

Wilma Grambusch (heir of Kamakana) was actively trying to sell her property during the year. The refuge received several requests for information on access to this area.

2. Easements

1983: Wilma Grambusch (heir to Kamakana) contacted the refuge regarding access to her property along the northern boundary of

Kakahaia NWR. She wanted access provided to 4 parcels, which are landlocked by the refuge's northern boundary. An easement was granted for an alternate route along the refuge's northern boundary--inside the refuge, but outside the refuge fence.

1984: The easement right-of-way along the northern boundary of the refuge was cleared of large branches and fallen trees several times during the year.

3. Other

1983: Refuge Manager Shallenberger and DAWR Chamberlain presented refuge revenue sharing checks to Mr. Claro Capili, executive assistant to the mayor of Maui County, on March 8, 1983. The two checks totaled $4,654, based upon a calculation of .75% of the appraised fee value.

1984: PIA Marmelstein, along with Shallenberger and Krakowski, delivered the refuge revenue sharing check for Kakahaia NWR to Maui Mayor Tavares on 3/6/84. The $5,663 check was based on .75% of the appraised fee value.

E. ADMINISTRATION

1. Personnel

1984: Jim Krakowski, the new Wetlands Refuge Manager, came on board January 8. He visited the Kakahaia NWR on 1/25 for the first time.

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

F. HABITAT MANAGEMENT

1. General

This 44.6 acre refuge consists of a centrally located 15 acre spring-fed wetland area which was formerly used for rice and taro cultivation. 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 consists of 4 acres of open water surrounded by 11 acres of dense bulrush. A thick agal mat coveres 50-80% of the open water area. Waterbird use of this spring-fed wetland was restricted, for the most part, to the open water pond (average depth ca. 50-70 cm.) and the bulrush border surrounding the open pond.

1983: With the help of BLHP monies, the refuge expanded the waterbird habitat by completing two projects during the summer of 1983: (1) the 11-acre bulrush stand was opened up 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 will be 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 Menzi Muck work in the 15-acre wetland was accomplished during the spring months. The shallow water impoundment work was completed during the months of June. Professor Don Avery donated a prototype of one of his innovative low-lift fiberglass pumps for this windmill. However, this fiberglass model did not work well and, by the end of the year, was scrapped. The refuge added a standard six inch brass pump. Windmill work took place during the fall months with completion expected in early 1984.

The Menzi Muck in action on Kakahaia NWR. RAC

The Menzi Muck excavated radiating channels from the original central open pond. Refuge slide file.

1984: Despite the fact that 1984 was a dry year and the 8 foot Dempster windmill was constantly drawing from the 15-acre wetland, the spring continued to provide adequate water for this pond and the new 5.5-acre shallow water impoundment.

The new 5.5 acre shallow water impoundment. RJS

One problem did become evident during the year. We learned that the 1983 BLHP channel project did have some drawbacks. Spoil dikes from the channels created dry land areas in the wetland and Pluchea spp. has grown on these dikes. This is a plant that 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 new 5.5-acre impoundment contained only about 1/3 of its water capacity during the first part of the year. This was due to pumping problems (Sec. I.4). After installing some additional pumps to the windmill, water levels varied from three quarters to almost full for the rest of the year.

The culvert leading across the highway that drains the main wetland remained plugged with sand during the year. The county normally maintains this culvert. The refuge, however, has no complaints; we lose less fresh water when the drain is plugged.

3. Forests

1983: Upland areas of the refuge are covered by dense stands of haole koa (*Leucaena glauca*), kiawe (*Prosopis pallida*), and *Pluchea* spp.

1984: A contract was issued during 1984 to clear portions of this vegetation that was encroaching on the boundary fence (Sec. I.2).

11. Water Rights

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

G. WILDLIFE

2. Endangered Species

1983: The Hawaiian coot and stilt are the typical endangered species encountered on the refuge. Semi-annual census indicated an average population of 30-35 coots during 1983. Four to six stilts were also occasionally seen on the refuge. A coot nest check on 3/8/83 located 6 platforms and 3 active nests.

On May 13, 1983, 3 pair of Hawaiian moorhen were transplanted from Oahu to Kakahaia NWR. Previous to that date, moorhen were not to be found on this island. The birds were captured at Haleiwa lotus fields on Oahu. They are numerous here and cause problems for the lotus farmers. State wildlife personnel assisted with the capture, banding, and marking of the birds. The birds were neck-collared and observed occasionally throughout the rest of the year.

Three of the six moorhen released at Kakahaia NWR; notice the blue neck-collars. Refuge slide file.

1984: Stilt responded positively to the BLHP shallow water impoundment project of 1983. Prior to this project, it was uncommon to observe the stilt on the refuge. In 1984, counts ranged from 20-40 with a high of 53 on 11/19. The birds also nested on the refuge for the first time; we know of 4 stilt that fledged. In addition, we have information on other stilt nesting attempts that may have fledged more young: 5 more hatched and survived at least a few weeks, and two other clutches were incubated.

The Hawaiian coot also responded to the BLHP channelization project. Monthly counts jumped from the 1983 average of 35 to 150. A peak of 170 coots were counted on 8/2. Coots were observed in all of the newly channelized areas and in the new pond. Coot nesting was also recorded in the newly created channels.

Krakowski and Shallenberger observed two moorhen on the refuge in January. Krakowski and Shallenberger observed one moorhen in February. That was the last time in 1984 that a moorhen was observed on the refuge.

With the addition of the 5.5 acre impoundment, Kakahaia NWR was in the new business of managing for stilt. RJS

3. Waterfowl

1983: Limited waterfowl use of the refuge has been noted during the winter months. Northern shoveler, American wigeon, and green-winged teal are commonly seen on the refuge, however, they usually number less than 15.

1984: Limited waterfowl use of the refuge has been noted during the winter months. Pintail (10-20), northern shoveler (4), American wigeon (1), and green-winged teal (4) were commonly seen on the refuge. Their numbers have increased with the addition of the new 5.5 acre impoundment.

4. Marsh and Waterbirds

Only a few indigenous black-crowned night herons are regularly observed around the edge of the open water area. No heron nesting was observed on the refuge during 1983 or 1984.

1984: Cattle egrets are now seen on the refuge and usually number less than 5.

5. Shorebirds, Gulls, Terns, and Allied Species

The new 5.5-acre impoundment also added shorebird habitat to the refuge. These are migrating and wintering birds that use the refuge during the fall, winter, and spring months. Common species include: American golden plover (8-10), ruddy turnstone (20-30), sanderling (20-30), and tattler (1-4).

Two to four lesser yellowlegs were observed infrequently during the winter months.

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 water regularly at the pond.

15. Animal Control

The mongoose is quite numerous on the island of Molokai. Normally the refuge traps these animals on the endangered waterbird refuges. However, time and manpower constraints prevent trapping on Kakahaia NWR. The refuge had been investigating the possibility of contracting out the trapping in 1984, with no success.

1984: There are about six dogs that have been visiting the refuge on a frequent basis. Some had collars and Woodside located owners and advised them of the current leash laws. The local dog catcher was also advised of the situation.

H. PUBLIC USE

1. General

Kakahaia NWR is located immediately adjacent to the southern coastal highway and only 5 miles east of Kaunakakai, the largest town on the island. Traffic on this road is very light and most travelers pass by the refuge without seeing this important wetland. A tall, dense stand of bulrush shields any view of the open pond from the highway. However, if such a view was afforded to the local residents and the number of limited tourists, there could be increased disturbance and/or poaching of the endangered coot. With no FWS staff on the island, this problem would be difficult to control.

In 1984, Paul Carothers, legislative aid to Congressman Breaux, La., visited the refuge on 11/27 with Leinecke and Krakowski. The endangered waterbirds and refuge management were discussed.

2. Outdoor Classroom - Students

1984: A meeting was held on 1/26 with Hawaii Department of Education officials to discuss how the FWS could serve the local schools. They were unaware of the Kakahaia NWR, but indicated an interest in using it as an outdoor classroom.

6. Interpretive Exhibits/Demonstrations

1984: Dick Kuehner, Regional Office I&R Specialist, along with Shallenberger and Krakowski, visited the refuge on 1/25. Interpretive exhibits and signs for the refuge were discussed. An entrance sign, parking area rehab, observation tower, and interpretive signs were specifically planned.

9. Fishing

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

14. Picknicking

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

17. Law Enforcement

In 1984, one junk car was abandoned on the refuge. With police help, attempts were made to track down the owner. However, the person could not be located and Woodside towed the vehicle to the local dump.

I. EQUIPMENT AND FACILITIES

1. New Construction

1983: Ron's Construction of Oahu won the contract to do the BLHP project at Kakahaia NWR. The Menzi Muck started work on 3/7/83 and completed work in the pond in late April. The shallow water impoundment work started on 3/21/83. A Cat 977 first cleared the area of trees. A JD 450 completed the project in June.

An eight-foot Dempster windmill was also constructed during the summer of 1983. The mill lifts water from the 15-acre wetland to the shallow water impoundment. A total of $128,000 was spent on new construction at Kakahaia NWR in 1983.

1984: Woodside purchased a small metal storage shed from Sears for storage of refuge equipment. He erected the building within the Hawaii Department of Forestry maintenance compound on Molokai with their permission.

2. Rehabilitation

1984: Local resident, Vili Oto, was contracted to clear vegetation along the refuge boundary fence. He cleared most of the north and south fenceline of haole koa and kiawe for $1,900.

4. Equipment Utilization and Replacement

1984: At the start of the year, the windmill was driving two 6" cylinder pumps. With good trade winds, the pumps would lift 75 gallons per minute into the 5.5-acre impoundment. This was not enough to fill the pond with the prevailing wind conditions. Two more 6" pumps were added to the system. Woodside, with the help of Pacific Electric Mechanical of Molokai, fabricated the mechanism to make it work. On 6/14, all four pumps were working and the pond soon filled up. However, other parts of the mill broke down during the rest of the year, so the pond fluctuated between half and three-quarters full for that period.

The 8-foot Dempster windmill at Kakahaia NWR. Refuge slide file.

Output from the windmill's two six-inch pumps was not enough to fill the 5.5 acre pond. RJS

The refuge truck kept on Molokai went in for a major tuneup and brake overhaul during the year. Also, the passenger window mechanism was replaced.

6. Energy Conservation

1983: The eight foot Dempster windmill will result in considerable savings in pumping costs. The 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.

7. Other

1984: Bill Striplin, Regional Office, Engineering, visited the refuge on 3/15 to inspect BLHP projects completed in 1983.

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.

1983: AECOS of Hawaii conducted a nutrient analysis from a single water sample collected from Kakahaia NWR on 10/12/82 with the following results:

Nutrient	ug-at/l	N:P Ratio
Inorganic nutrients:		
$NO_2 + NO_3$-N	<0.02	
NH_4 - N	41.2	10.5
PO_4 - P	3.94	
Total nutrients:		
TPN	161.6	
TPP	4.30	37.6

The inorganic nutrient concentrations are quite high indicating that neither nitrogen nor phosphorus are limiting primary production. These data suggest that Kakahaia NWR is a highly productive environment.

HAWAIIAN ISLANDS NWR

BI-ANNUAL NARRATIVE REPORT

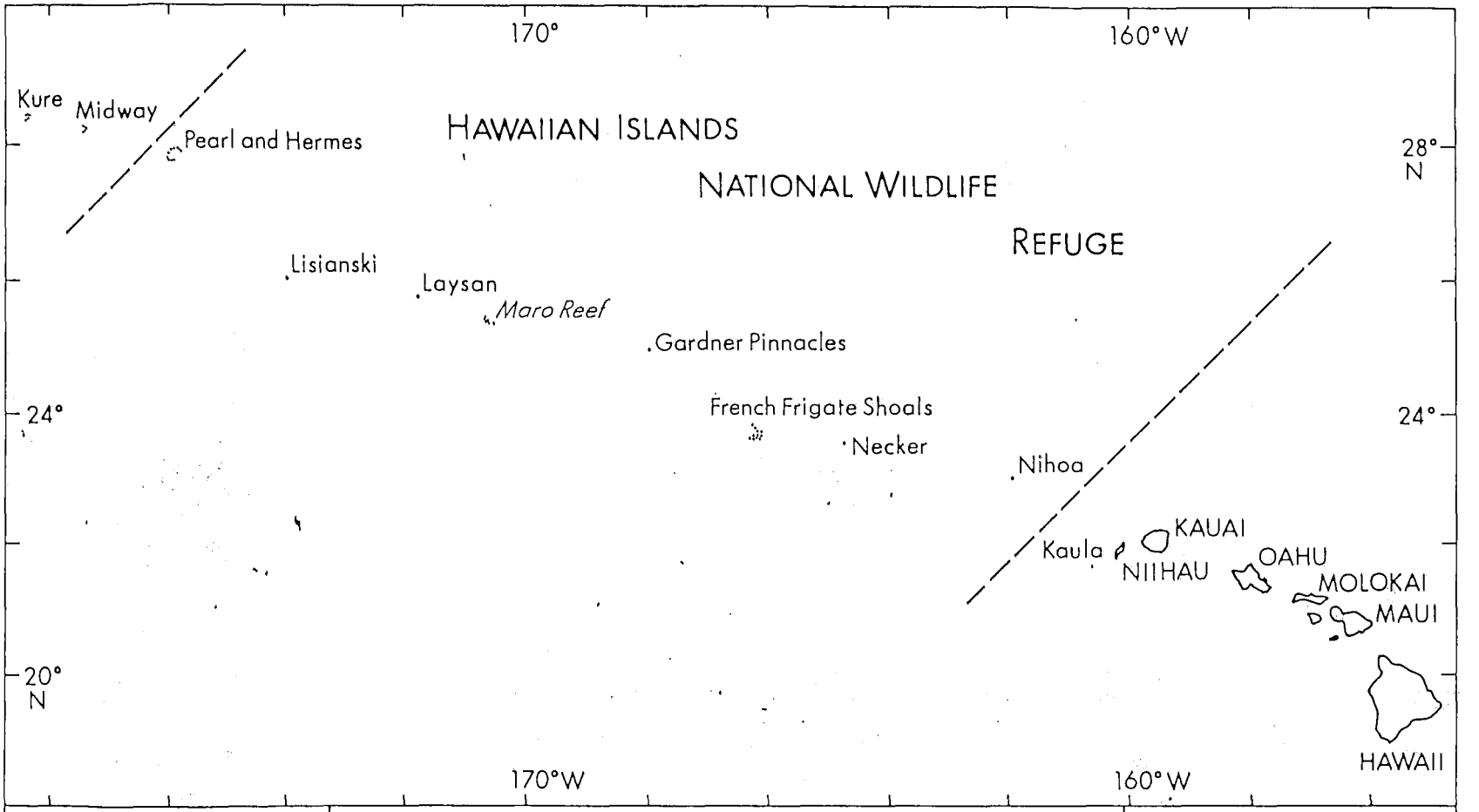
Calendar Years 1983 and 1984

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

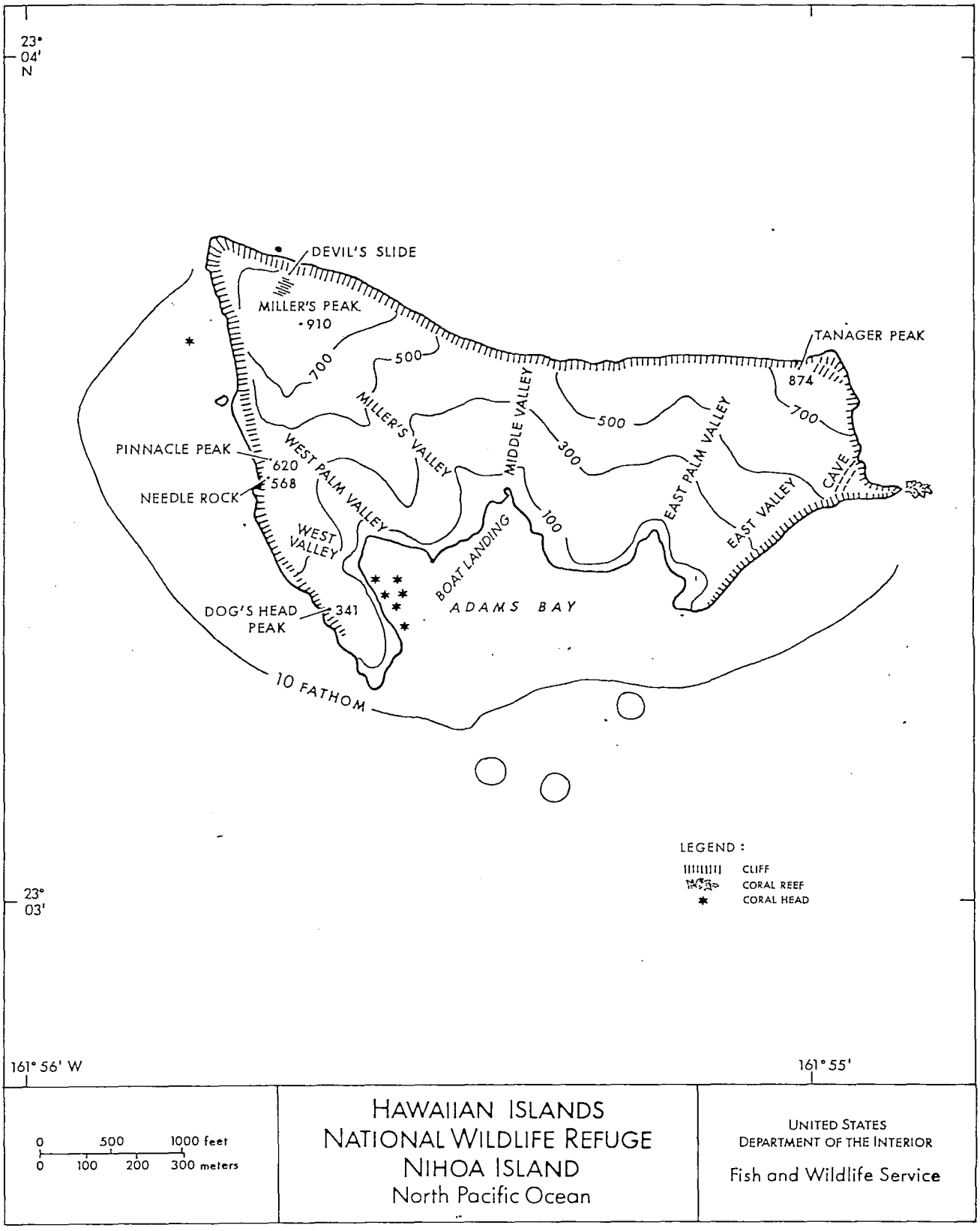
INTRODUCTION

The Hawaiian Islands National Wildlife refuge 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 252,700 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. Absence of beaches and sheer cliffs of basalt 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 rocks 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 round 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 threaened green sea turtle, and furnishes habitat for 13 candidate endangered plants, 32 candidate terrestrial invertebrates, and a diverse array of marine fishes and invertebrates.



Fish and Wildlife Service	HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE North Pacific Ocean	UNITED STATES DEPARTMENT OF THE INTERIOR



0 500 1000 feet
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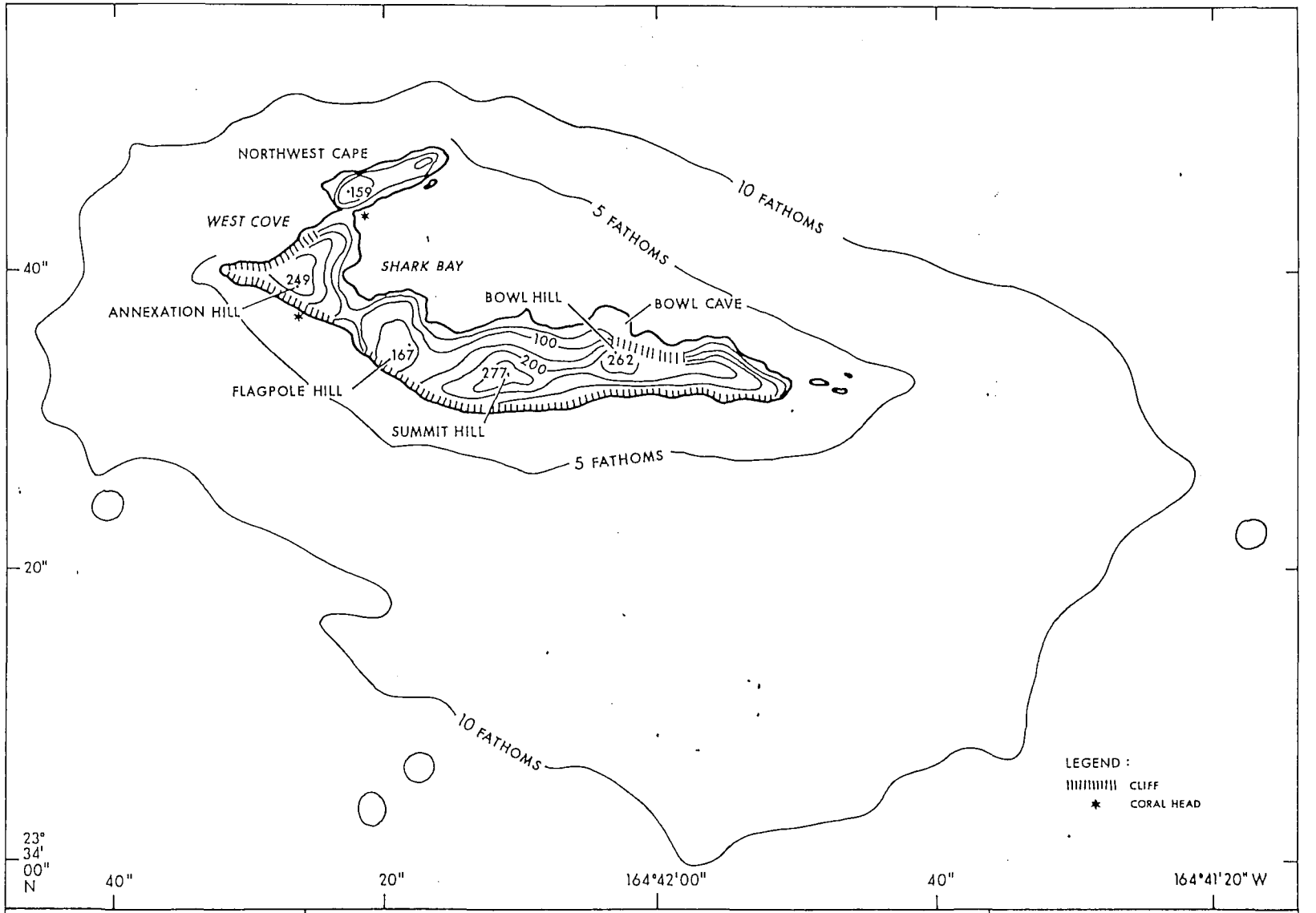
HAWAIIAN ISLANDS
NATIONAL WILDLIFE REFUGE
NIHOA ISLAND
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



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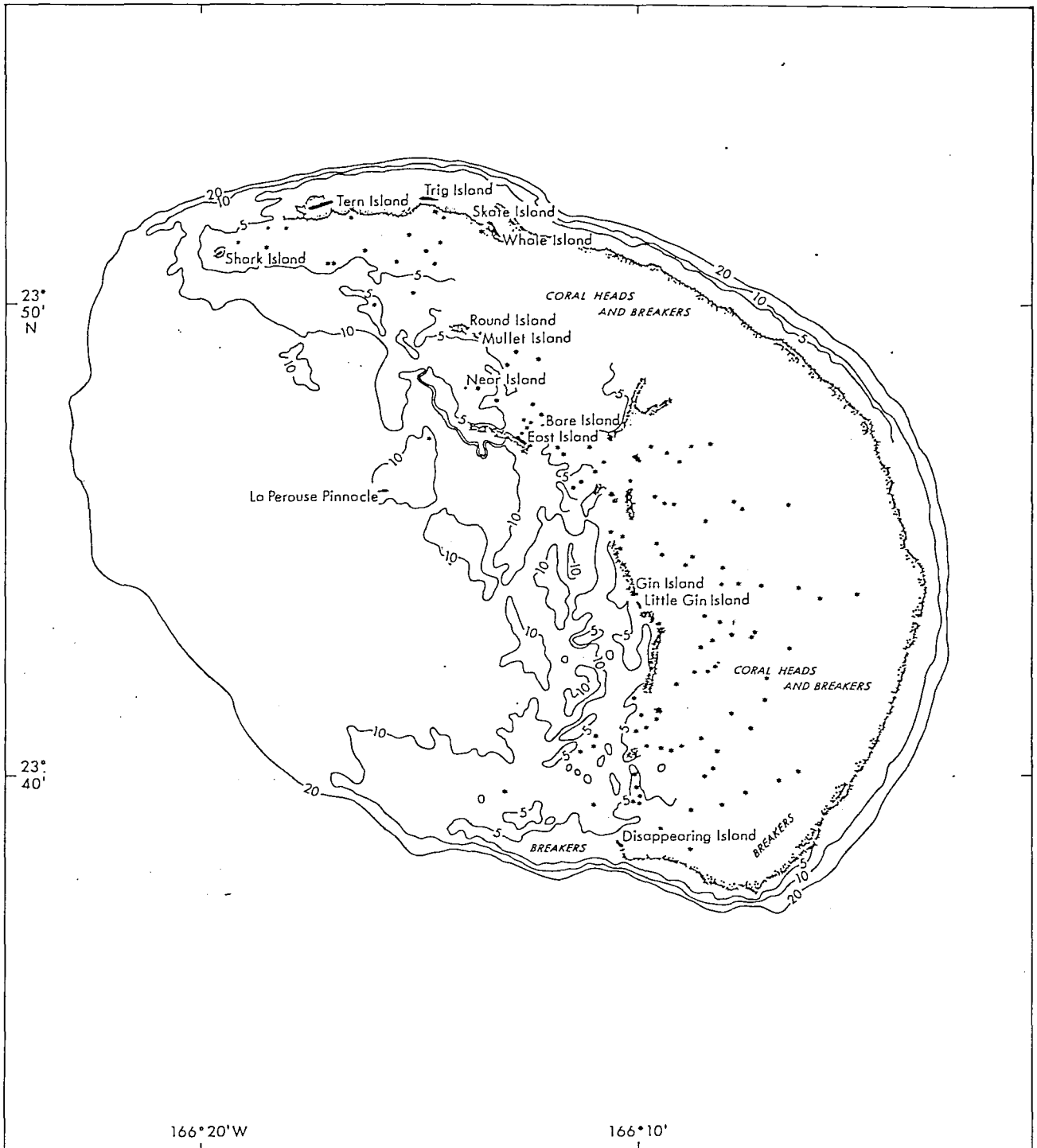
HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE
NECKER ISLAND
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



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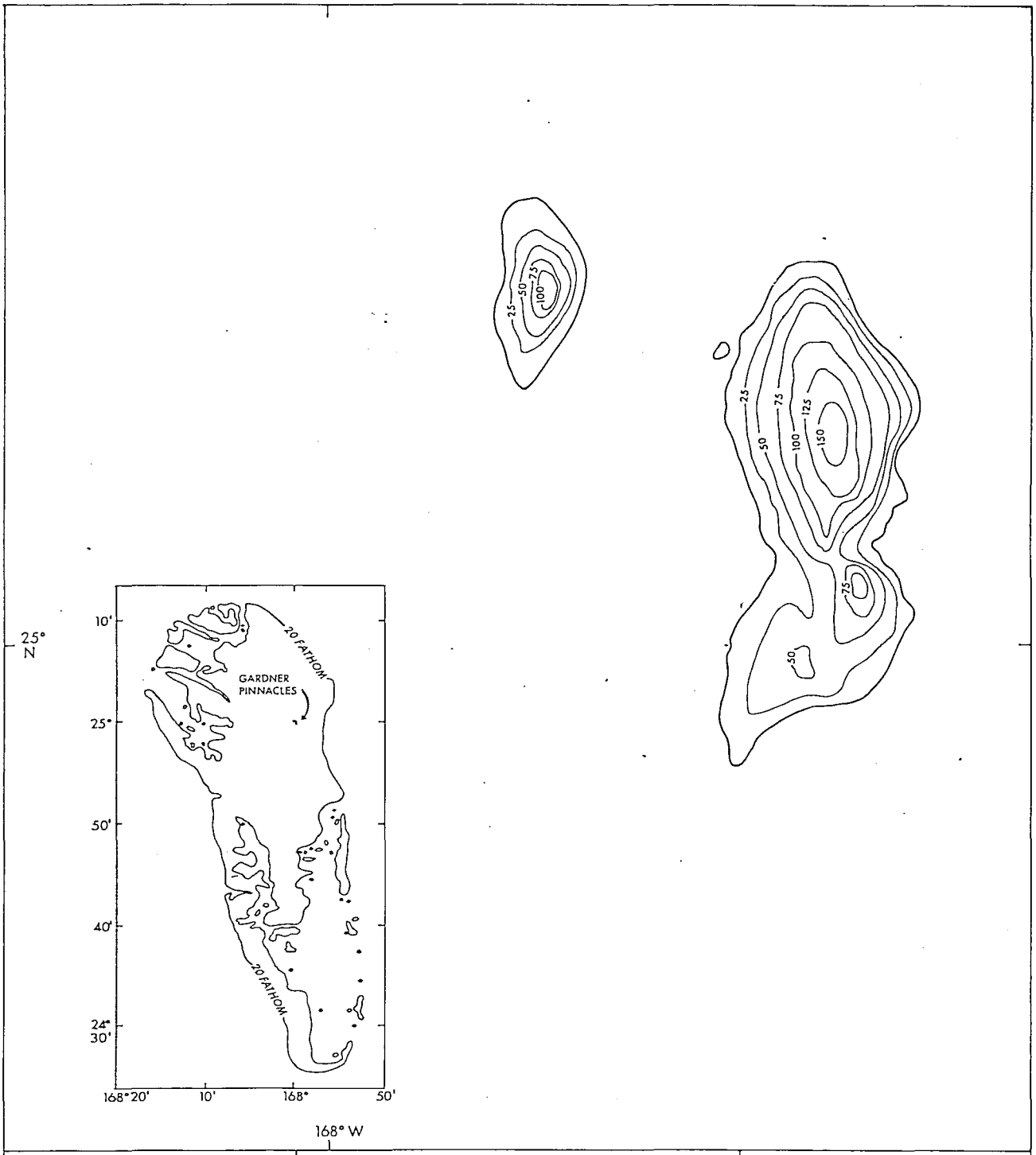
0 5000 meters

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE FRENCH FRIGATE SHOALS

North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service



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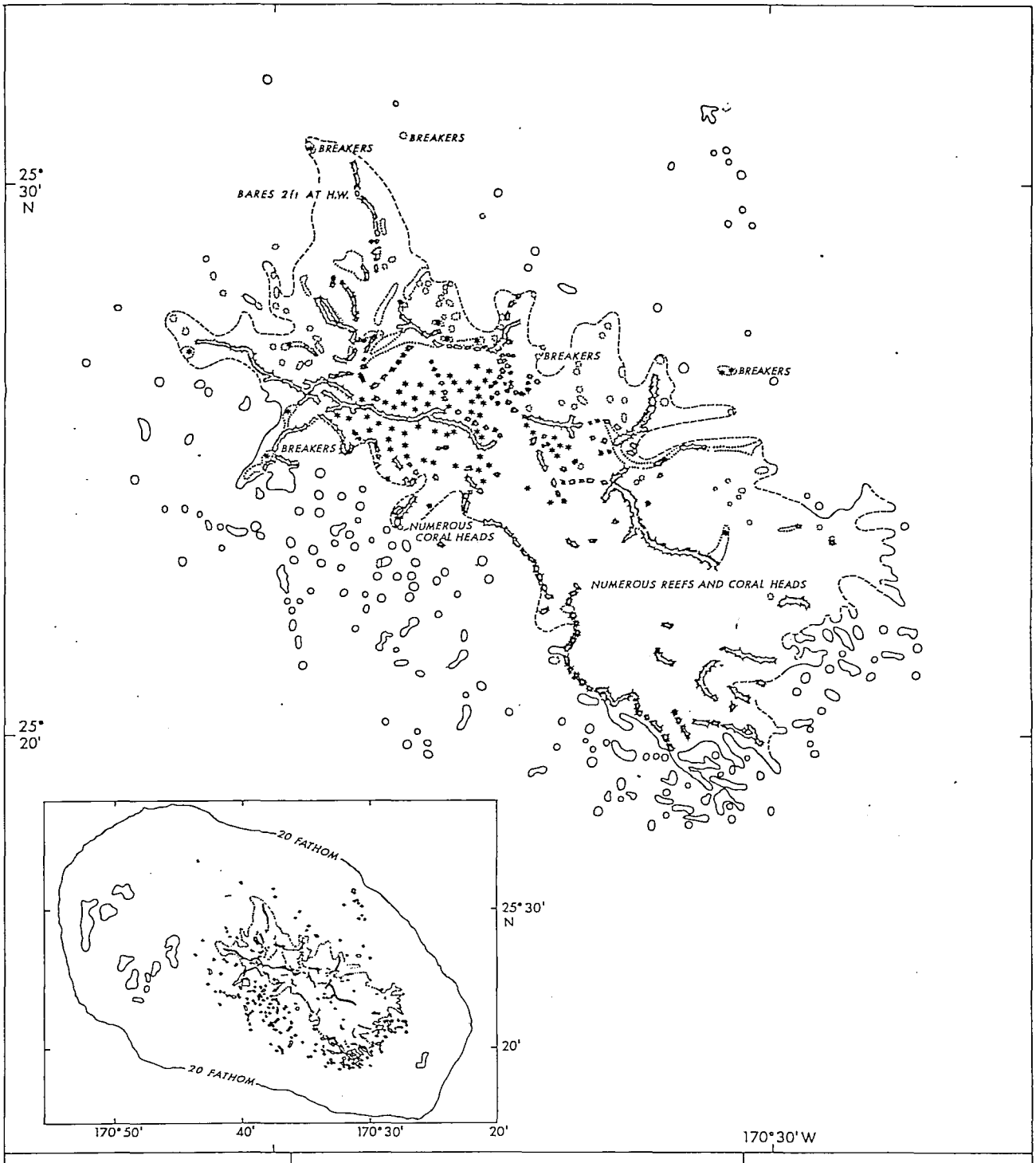
HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE GARDNER PINNACLES

North Pacific Ocean

UNITED STATES DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

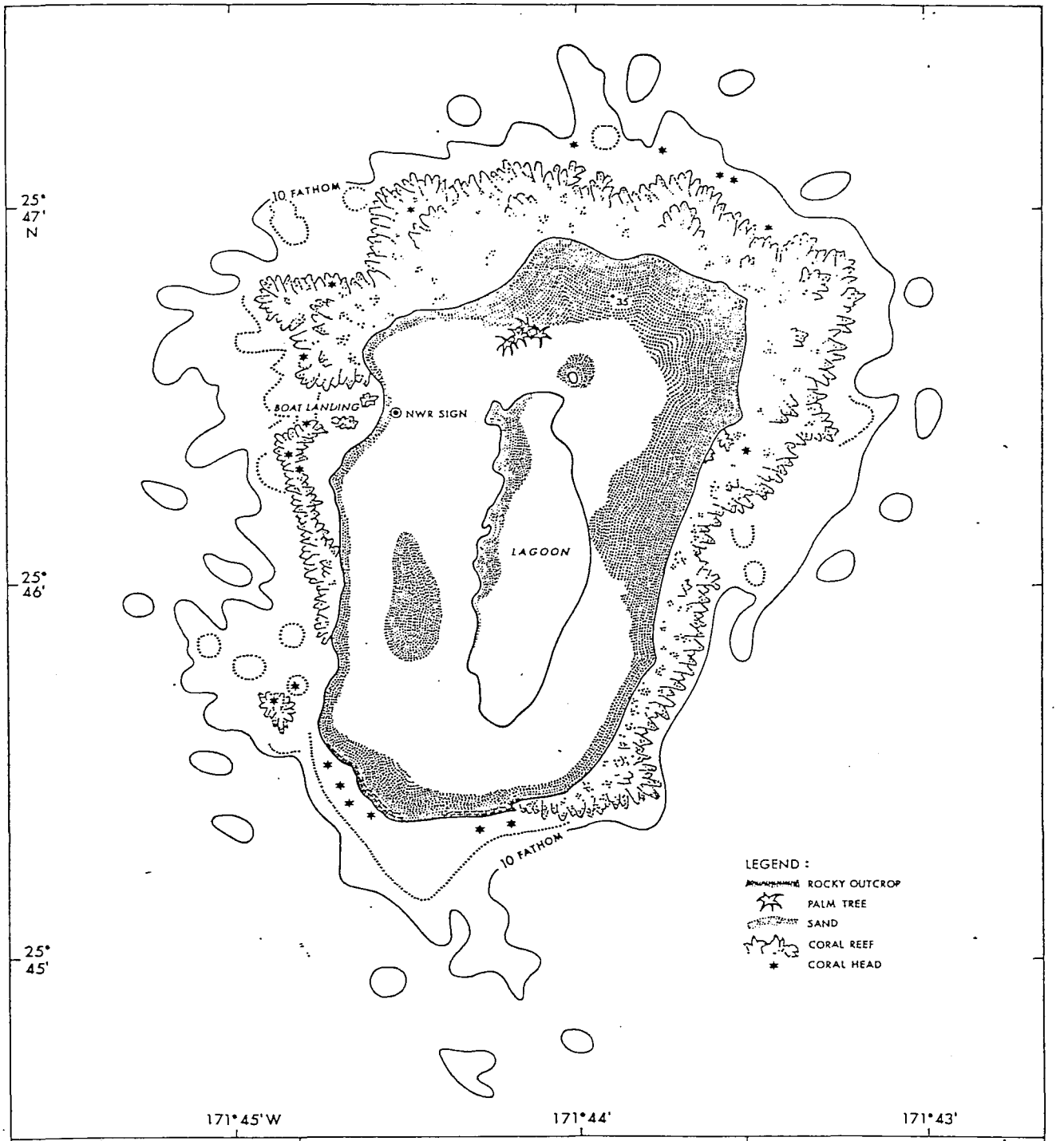


0 500 1000 1500 2000 feet
0 200 400 600 meters

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE
MARO REEF
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR

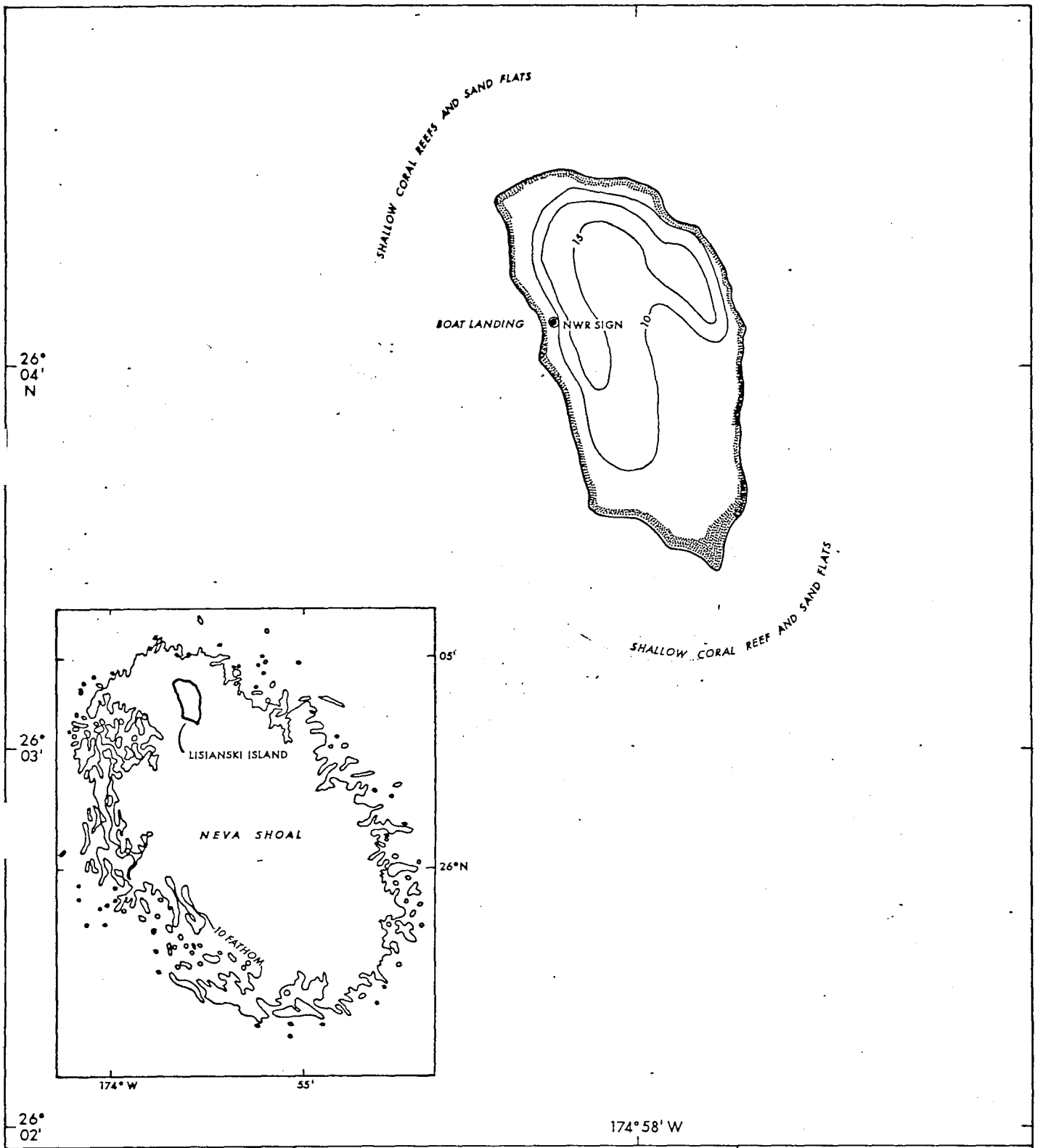
Fish and Wildlife Service



0 1000 2000 3000 feet
0 400 800 meters

HAWAIIAN ISLANDS
NATIONAL WILDLIFE REFUGE
LAYSAN ISLAND
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



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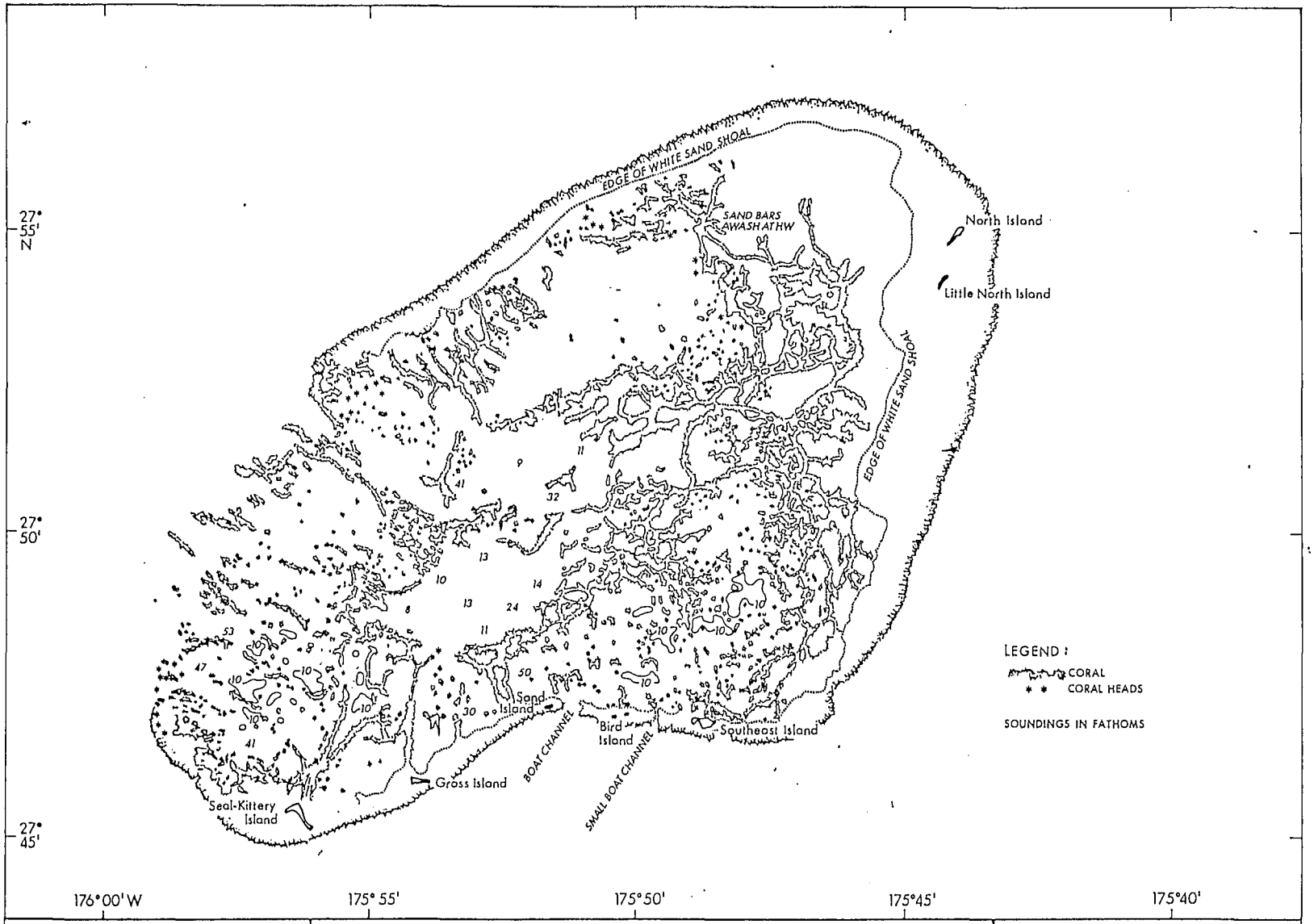
0 400 800 meters

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE
LISIANSKI ISLAND
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service



0 2000 4000 6000 feet
0 500 1000 1500 meters

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE
PEARL AND HERMES REEF
North Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

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A. HIGHLIGHTS

1983: The Northwestern Hawaiian Islands Symposium held in Honolulu on May 23-25 was very successful. The objective of this symposium was to summarize the results of research conducted under the Tripartite Cooperative Agreement. Pacific Islands Administrator Coggeshall and Refuge staff, including Complex Manager Shallenberger, and Wildlife Biologists Fefer, Naughton, and Harrison, presented papers on management and research conducted during the Tripartite studies. Assistant Secretary Arnett presented a luncheon talk and Director Jantzen presented a talk on Management.

A Master Planning effort was formally announced at the Tripartite Symposium in May and considerable time was spent on the development of this plan.

A cruise to the remote islands of the refuge was conducted in July/August to monitor seabird population status and to survey endangered birds, plants and terrestrial arthropods.

A wedge-tailed shearwater banded at Tern Island in 1980 was recovered in September, 1982, in Guatemala.

The first successful great frigatebird nest was recorded on Tern Island.

Three of the four employees directly associated with the refuge, including Refuge Manager Ludwig, Assistant Refuge Manager Andre, and Biological Technician Brady, left during the year. Their departure left a serious gap in management continuity.

1984: The draft Master Plan/Environmental Impact Statement for the Hawaiian Islands NWR was released on August 31 for public comment. Public meetings were held March 20 and September 12 to obtain comments on plan objectives and resource management alternatives.

Archaeological research was conducted at Nihoa and Necker Islands under a Cooperative Agreement with the Bishop Museum. The final report will describe the cultural resources of these islands, discuss their prehistory, and recommend strategies for cultural resource management.

A record number of Hawaiian monk seals was observed at Tern Island November 5 when 113 were seen basking on the beaches. Less than half a dozen seals regularly hauled out on these beaches when the U.S. Coast Guard turned the island over to the FWS in 1979.

A cruise to the remote islands of the refuge was conducted in June/July to monitor seabird populations and terrestrial habitats, to survey endangered birds, and to conduct archaeological research. A field camp was established at Laysan

Island during the spring and summer to monitor seabird and Hawaiian monk seal populations, to conduct a vegetational survey and to investigate the biology of the hypersaline lagoon as it relates to the Laysan duck.

Two lines of drift fence totalling 640 feet were erected on Laysan Island in November to prevent sand from blowing through a devegetated area and filling the lagoon.

B. CLIMATIC CONDITIONS

Weather conditions are variable because of the change in latitude but generally are 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 forcasting, no long-term records are maintained. U.S. Fish and Wildlife refuge personnel collect long-term weather data on a daily basis.

The following data are from the 1983 and 1984 station logs:

The mean temperature for 1983 was 73.3 degrees F., the mean maximum was 79.8 degrees F., and the mean minimum was 66.8 degrees F. February was the coolest month with a mean of 68.0 degrees F. The coolest temperature of the year was recorded on December 12 and was 58 degrees F. September was the warmest month with a mean of 77.6 degrees F. The temperature reached a maximum of 86 degrees F. on eight days in September and on October 5 and November 24. Northeast tradewinds averaged 13.0 knots during the year with gusts up to 60 knots recorded in November and December. Precipitation for the year totaled 19.64 inches with 4.65 inches falling in December, the wettest month, and 0.50 inches in February, the driest month. High surf conditions on January 24 caused erosion in the tide gauge area.

1984 appeared to be warmer and wetter than 1983, although the installation of a new thermometer might be the reason for higher temperatures. The 1984 data from the Tern Island log are summarized as follows: mean annual temperature was 78.4 degrees F, the mean maximum was 81.9 degrees and the mean minimum was 73.6 degrees. February was the coolest month with a mean of 73.2 degrees. The coolest temperature of the year was recorded February 1 and was 60 degrees. September was the warmest month with a mean of 81.0 degrees. Maximum temperature for the year was 90 degrees recorded May 12. Northeast trades averaged 11.2 knots during the year with gusts up to 30 knots recorded in November. Precipitation for the year totaled 32.72 inches with 8.01 inches falling in October, the wettest month and 0.38 inches

in May, the driest month. A summary of the weather data from 1983 and 1984 is provided below:

Temperature (F)	1983	1984
Annual mean temperature	73.3	78.0
Mean maximum temperature	79.8	81.9
Mean minimum temperature	66.8	73.6
Maximum temperature	86.0	90.0
Minimum temperature	58.0	60.0

Precipitation (Inches)		
Total annual precipitation	19.64	32.72
Wettest month	4.65 (Dec.)	8.01 (Oct.)
Driest month	.50 (Feb.)	.37 (Feb.)

Wind Velocity (Knots)*		
Annual mean wind velocity	13.1	11.2
Maximum wind velocity	60.0	30.0

* Wind velocity was usually recorded as an instantaneous event about 8:00 a.m. each morning, although higher gusts might occur during the day.

Data collected during seabird monitoring studies indicate that the occurrence of an El Nino in 1982-1983 may have affected certain reproductive parameters (see HWN-3-83&84 under Research and Investigations).

D. PLANNING

1. Master Plan

1983: The Master Plan was first announced at the early May meeting of the Hawaii Fishery Coordinating Council. It was formally announced at the Tripartite Symposium on the Northwestern Hawaiian Islands May 25-27 and in a FWS news release dated June 22. A schedule was formulated calling for completion of the Master Plan/EIS by the end of FY 1984. Paul Camp, Division of Engineering, Regional Office, was assigned to work with the RWR staff on the plan. A list of the historical events relating to the various management issues included the boundary dispute with the State of Hawaii, jurisdiction and management of Tern Island, Hawaiian monk seal and green sea turtle management and recovery, cultural resource management and monitoring studies.

Refuge output narratives and locational criteria were drafted late in the year after much deliberation and thorough evaluation of mandates and policies.

Complex Manager Shallenberger was interviewed on October 14 by Sylvia Rogers, writer for Hawaiian Fishing News, regarding the Hawaiian Islands NWR Master Planning process.

Several workshops were held to explain the Master Planning process and refuge management objectives to groups such as the Hawaii Audubon Society and the University of Hawaii.

1984: Paul Camp and Harvey Lee arrived in Hawaii on January 30 from the regional office for a one week Master Planning session with the refuge staff. Plan objectives were finalized and preliminary alternatives drafted. Preparations for a Master Plan workshop in March were initiated. A public workshop was held on March 20 to obtain comments and suggestions relative to plan objectives and management alternatives.
The draft Master Plan/Environmental Impact Statement for the Hawaiian Islands National Wildlife Refuge was released on August 31. Over 130 copies were distributed for review and comment.

A second public meeting was held September 12 to further explain the planning process and to gain additional comments on the draft. Public comments were invited through October 31.

By the end of the year, the refuge staff had incorporated public and internal comments and replies to the individual commentators in the draft, and forwarded it to the Regional Office for further input, review, and finalization. Distribution of the Preliminary Final Master Plan/EIS for internal review/approval was scheduled for January, 1985.

2. Management Plan

An Oil Spill Contingency Plan for remote island refuges was completed and incorporated in the Oil and Hazardous Substance Pollution Contingency Plan promulgated by the U.S. Coast Guard, Marine Safety Office, Honolulu. The plan directs coordinated responses to oil spills and lists equipment and requirements for an oiled bird rehabilitation facility.

The Hawaiian Islands NWR Disease Contingency Plan was completed and accepted by the Regional Office on August 31, 1983. The plan is intended to 1) prevent the establishment of new or exotic diseases in native bird populations; 2) reduce losses of birds through disease; 3) diminish the impact of disease outbreaks on endangered or threatened species; and 4) reduce the potential for the spread of contagious diseases from one population to another.

A draft of the Hawaiian Islands NWR Exotic Mammal Introduction Contingency Plan was completed. Its purpose is to document the protocol to follow and the equipment required to avoid, detect

and exterminate rodent introductions within the HINWR.

3. Public Participation

1983: To keep the public informed of the Master Planning process and as a means of soliciting their input, a series of Planning Updates was inaugurated in July. Planning Update No. 1 was mailed to 357 individuals, agencies and organizations. It discussed the Master Planning process and objectives and requested the reader to rank issues and concerns relative to management of the Hawaiian Islands NWR. Over 100 responses were received.

A total of 498 copies of Planning Update No. 2 were mailed in October. In addition to summarizing the responses to the first Update, it defined and discussed outputs that were being produced at present and that might be produced in the future. It also solicited the reader's input regarding additions or modifications to the list.

1984: Public participation in the Master Planning process was emphasized during 1984. A presentation on Master Planning was made by Complex Manager Shallenberger at the January 30-31 meeting of the Western Pacific Regional Fishery Management Council. In October, Refuge Manager Wass discussed the Master Plan with the Hawaii Fisheries Coordinating Council, a body that advises the Governor on matters pertaining to fisheries policy and development in the State of Hawaii.

In March, Planning Update No. 3 was distributed to over 550 concerned individuals, agencies, and organizations. Its purpose was to 1) share the highlights of previous public involvement efforts; 2) present objectives for wildlife resources and public use activities in the HINWR; 3) present alternatives for management, development and use of the refuge; 4) invite the public to a workshop; and 5) request additional comments and suggestions.

A public involvement workshop was held March 20 at McCoy Pavilion-Ala Moana Beach Park in Honolulu. It was designed to obtain comments and suggestions on the refined objectives and mangement alternatives presented in Planning Update No. 3. Valuable input was received from the workshop and the responses to the third Planning Update which enabled 1) reducing the number of management alternatives under consideration; 2) making minor changes in the refuge output list priorities; and 3) refining several key strategies in various management alternatives. Most importantly, this input provided valuable assistance in the development of the FWS' Preferred list of management strategies.

Planning Update No. 4 was mailed to the public and concerned agencies in August. Its purpose was to 1) summarize the highlights of the public involvement workshop; 2) announce the

FWS' preferred management alternative for the HINWR and the anticipated environmental consequences; 3) notify the public of the August 31 availability and opportunity to review the Draft Master Plan/EIS; and invite the public's participation in the second Master Planning Workshop scheduled for September.

The second public workshop was held at McCoy Pavilion-Ala Moana Beach Park on September 12. Management strategies, particularly those comprising the FWS' Preferred Alternative, were discussed and recommended by 41 attendees during small group sessions. The participants were in general agreement with most of the Preferred Alternative strategies, but numerous suggestions were made for refinement and clarification.

In addition to the comments received during the second workshop, 28 letters were received by the end of the year from agencies and individuals with comments on the Master Plan.

4. Compliance with Environmental and Cultural Resource Mandates

1983: Extensive discussions were initiated to ensure that the Master Plan would comply with environmental and cultural resource mandates.

Section 7 consultations were requested from Gene Nitta of the National Marine Fisheries Service and from Lucian Kramer of the FWS for a Special Use Permit for the use of rotonone by Dr. James Parrish at French Frigate Shoals. Dave Lenhardt of the Regional Office indicated that no special permit was required for this type of rotonone use (i.e. to do fish collections). Both agencies issued no jeopardy opinions.

1984: A cooperative Agreement between the FWS and the Bernice P. Bishop Museum, Honolulu, was signed in June for the purpose of gathering data for management of prehistoric cultural resources of the Hawaiian Islands NWR. Under this agreement, archaeological research was conducted on the islands of Nihoa and Necker between June 19 and July 4, 1984, by Dr. Paul Cleghorn and Mr. Eric Komori. Specific tasks were to: determine the accuracy of the archaeological resources survey conducted by Kenneth P. Emory in 1928; determine whether any significant deterioration of sites has occurred since that survey; and determine whether significant sites were missed by that survey. Background research was also conducted to review all available data, written and artifactual, regarding the prehistory of Nihoa and Necker to determine what archaeological research had been done on the islands, what had been collected, and what the general theories on the prehistoric occupation of these islands are. The research will result in a report which 1) describes the archaeological sites and their significance, 2) discusses the prehistory of the islands, and 3) recommends management strategies for cultural resources. Nihoa and Necker Islands will also be nominated as Archaeological Districts on the Natonal Register of Historic Places.

Dr. Paul Cleghorn and Eric Komori conducting the archaeological survey at Nihoa Island. RJS

5. Research and Investigations

Research pursuant to the Tripartite Cooperative Agreement signed by representatives of the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, the State of Hawaii Department of Land and Natural Resources, and the University of Hawaii Sea Grant Program, concluded in 1983.

This agreement resulted in a multi-agency research program involving the three signatory agencies and the University of Hawaii Sea Grant Program. Research focused on the determination of abundance and distribution of major terrestrial and marine vertebrates and selected marine invertebrates. Additional research addressed the interaction between the terrestrial resources (including seabirds, endangered Hawaiian monk seals, and threatened green sea turtles) and those marine resources that are of potential commercial value. Particular emphasis was directed toward the possible effects of commercial or recreational fishing on the wildlife resources of the refuge. Much of the data were utilized in the development of a model of energy flow through the atoll ecosystem at French Frigate Shoals.

Refuge Manager Ludwig and Bio-techs Kramer and Eilerts coordinated the logistics of transporting researchers to French Frigate Shoals via boats and planes. Tern Island Assistant Managers Andre, Fairaizl, and Good provided assistance and hospitality to the visiting researchers.

The following research projects were conducted or continued during 1983-1984:

HWN-1-83 Tripartite Research

At the Second Symposium on the Northwestern Hawaiian Islands held in Honolulu during May 23-25, 1983, FWS presented a review of the marine and terrestrial bird research conducted as part of the Tripartite Agreement and a report on management objectives and policies for the refuge.

SYNOPSIS OF RESULTS OF RECENT SEABIRD RESEARCH CONDUCTED IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Stewart I. Fefer, Craig S. Harrison, Maura B. Naughton, and Robert J. Shallenberger

MANAGEMENT OF THE HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE.
Robert J. Shallenberger

The latter is appended to this narrative.

The Symposium proceedings also included the following research reports from other participants:

THE UNIQUE TERRESTRIAL BIOTA OF THE NORTHWESTERN HAWAIIAN ISLANDS.
Shiela Conant, Carl C. Christensen, Patrick Conant, Wayne C. Gagne, and M. Lee Goff.

THE HAWAIIAN MONK SEAL: A SYNOPSIS OF RESEARCH.
John R. Henderson and William G. Gilmartin

POPULATION STATUS AND ECOLOGY OF THE GREEN TURTLE IN THE NORTHWESTERN HAWAIIAN ISLANDS.
George H. Balazs

THE STRUCTURE OF REEF FISH COMMUNITIES IN THE HAWAIIAN ARCHIPELAGO.
Edmund S. Hobson

PRELIMINARY REPORT ON THE NEARSHORE FISHERY RESOURCE ASSESSMENT OF THE NORTHWESTERN HAWAIIAN ISLANDS, 1977-82.
Henry Okamoto and Brian Kanenaka

CIGUATERA RESEARCH IN THE NORTHWESTERN HAWAIIAN ISLANDS: LABORATORY AND FIELD STUDIES ON CIGUATOXIGENIC DINOFLAGELLATES IN THE HAWAIIAN ARCHIPELAGO.
Nancy W. Withers

BIOLOGY, DISTRIBUTION, POPULATION STRUCTURE, AND PRE-EXPLOITATION ABUNDANCE OF SPINY LOBSTERS, PANULIRUS MARGINATUS (QUOY AND GAIMARD 1825), IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Richard N. Uchida and Darryl T. Tagami

STUDIES ON RECRUITMENT IN THE HAWAIIAN SPINY LOBSTER, PANULIRUS MARGINATUS.
Criag D. MacDonald

TROPHIC RELATIONSHIPS OF NEARSHORE FISHES IN THE NORTHWESTERN HAWAIIAN ISLANDS.
James D. Parrish, Michael W. Callahan, Janice M. Kurz, James E. Norris, Anthony E. Sudekum, Geofferey Y. Akita, Joseph W. Banta, Allison Chun, Stephen K. Coffee, Mark A. DeCrosta, Steven D. Deldkamp, Anne E. Henry, Colin J. Lar, W. Glenn Lyle, Eric J. Magarifuji, Thomas J. Mirenda, S. Laurie Sanderson, Robert E. Schroeder, Morris H. Seigaku, Allan C. Solonsky, Carol T. Sorden, Leighton R. Taylor, Jr., and Alan K. Tomita

LIFE HISTORY, DISTRIBUTION, AND ABUNDANCE OF BOTTOMFISHES IN THE NORTHWESTERN HAWAIIAN ISLANDS.
James H. Uchiyama and Darryl T. Tagami
BIOLOGICAL CONSTRAINTS ON PRODUCTION AND RELATED MANAGEMENT ISSUES IN THE HAWAIIAN DEEPSEA HANDLINE FISHERY.
Stephen Ralston

ECONOMIC ANALYSIS OF DEEP BOTTOMFISHING IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Skippy Hau

SEAMOUNT FISHERY RESOURCES WITHIN THE SOUTHERN EMPEROR-NORTHWESTERN HAWAIIAN RIDGE AREA.
Robert L. Humphreys, Jr., Darryl T. Tagami, and Michael P. Seki

PELAGIC FISHERIES RESOURCES OF THE NORTHWESTERN HAWAIIAN ISLANDS
Thomas S. Hida

ECOLOGY AND PRODUCTIVITY OF CORAL REEFS IN THE HAWAIIAN ARCHIPELAGO.
Richard W. Grigg

PRIMARY PRODUCTIVITY, THE CYCLING OF NITROGEN, AND SPATIOTEMPORAL VARIABILITY IN COMPONENTS OF THE EPIPELAGIC ECOSYSTEM IN HAWAIIAN WATERS.
J. Hirota, R. Ferguson, J.A. Finn, Jr., R.F. Shuman, and S. Taguchi

ECOPATH - AN ECOSYSTEM MODEL APPLIED TO FRENCH FRIGATE SHOALS.
Jeffery J. Polovina

ECONOMICS AND ENVIRONMENTAL VALUES IN THE MANAGEMENT OF THE NORTHWESTERN HAWAIIAN ISLANDS FISHERY AND ENVIRONMENTAL RESOURCES.
Susan K. Miller and Jack R. Davidson

INSTITUTIONAL POLICYMAKING IN THE MANAGEMENT OF FISHERIES: CASE STUDY - STATE OF HAWAII.
Rose T. Pfund

STATE FISHERY REGULATIONS IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Paul Kawamoto

MANAGEMENT PLANS FOR FISHERY RESOURCES IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Justin Rutka

AGE DETERMINATION, GROWTH AND ENERGETICS OF THREE SPECIES OF CARCHARHINID SHARKS IN HAWAII.
Mark A. De Crosta, Leighton R. Taylor, Jr., and James D. Parrish

ADDITIONS TO SPECIES OF FORAMINIFERA FOUND IN SHALLOW WATER SEDIMENT OF THE HAWAIIAN ISLANDS.
Beatrice L. Burch, Thomas A. Burch, and Phillip Papish

RESULTS OF CIGUATOXIN ANALYSIS OF ENZYME-IMMUNOASSAY (EIA) OF FISHES IN THE NEARSHORE WATERS OF THE NORTHWESTERN HAWAIIAN ISLANDS.
L.H. Kimura, Y. Hokama, and M.A. Abad

AGE ESTIMATION AND GROWTH OF THE GRAY REEF SHARK CARCHARHINUS AMBLYRHYNCHOS FROM THE NORTHWESTERN HAWAIIAN ISLANDS.
Richard L. Radtke and Gregory M. Cailliet

SPAWNING AND GONADAL MATURATION OF THE EHU, ETELIS CARBUNCULUS, IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Alan R. Everson

MATURATION, SPAWNING AND FECUNDITY OF OPAKAPAKA, PRISTOPOMOIDES FILAMENTOSUS, IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Bert S. Kikkawa

GONADAL MATURATION, FECUNDITY, AND SPAWNING OF THE GREATER AMBERJACK, SERIOLA DUMERILI (RISSO), IN HAWAIIAN WATERS WITH REFERENCES TO CIGUATOXIN INCIDENCES.
Bert S. Kikkawa and Alan R. Everson

THE FOOD AND FEEDING HABITS OF THE GROUPER, EPINEPHELUS QUERNUS (SEALE 1901), IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Michael P. Seki

LENGTH-WEIGHT AND STANDARD LENGTH-FORK LENGTH RELATIONSHIPS OF DEEPSEA HANDLINE FISHES OF THE NORTHWESTERN HAWAIIAN ISLANDS.
James H. Uchiyama, Sally N. Kuba, and Darryl T. Tagami

RADIOIMMUNOASSAY RESULTS OF CIGUATERA ANALYSIS OF FISHES IN THE NORTHWESTERN HAWAIIAN ISLANDS, 1980-81.
Bernard M. Ito, Richard N. Uchida, Lance K. Shirai, Mary A. Abad, Lucille H. Kimura, and Yoshitsugi Hokama

CIGUATERA AND THE FEEDING HABITS OF THE GREATER AMBERJACK, SERIOLA DUMERILI, IN THE HAWAIIAN ARCHIPELAGO.
Robert L. Humphreys, Jr. and Steven H. Kramer

FOOD AND ENERGETIC REQUIREMENTS OF SEABIRDS AT FRENCH FRIGATE SHOALS, HAWAII
T.N. Pettit, G.C. Whittow, and H.I. Ellis

INVESTIGATIONS INTO ESCAPE VENT EFFECTIVENESS AND GHOST FISHING IN CAPTIVE POPULATIONS OF THE SPINY LOBSTER, PANULIRUS MARGINATUS.
Linda M.B. Paul

FEEDING REALTIONSHIPS OF GOATFISHES IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Carol T. Sorden

In addition, Tripartite Research in the Hawaiian Islands National Wildlife Refuge resulted in the following published papers and unpublished reports:

PUBLISHED PAPERS

HAWAIIAN SEABIRD FEEDING ECOLOGY
Craig S. Harrison, Thomas S. Hida, and Michael P. Seki

HEAVY METAL RESIDUES IN SOOTY TERN TISSUES FROM THE GULF OF MEXICO AND NORTH CENTRAL PACIFIC OCEAN.
D.L. Stoneburner and C.S. Harrison

SEABIRD PREDATION ON THE SEA-SKATER HALOBATES SERICEUS (HETEROPTERA: GERRIDAE).
L. Cheng and C.S. Harrison

THE HAWAIIAN MONK SEAL ON LAYSAN ISLAND: 1982.
Doris J. Alcorn

REVISED BIBLIOGRAPHY OF THE HAWAIIAN MONK SEAL MONACHUS SCHAUINSLANDI MATSCHIE 1905.
George H. Balazs and G. Causey Whittow

DIVING PATTERNS OF THE HAWAIIAN MONK SEAL, LISIANSKI ISLAND, 1982.
Fredrick V. Schlexer

GROWTH RATES OF IMMATURE GREEN TURTLES IN THE HAWAIIAN ARCHIPELAGO
George H. Balazs

RECOVERY RECORDS OF ADULT GREEN TURTLES OBSERVED OR ORIGINALLY TAGGED AT FRENCH FRIGATE SHOALS, NORTHWESTERN HAWAIIAN ISLANDS.
George H. Balazs

STATUS OF SEA TURTLES IN THE CENTRAL PACIFIC OCEAN
George H. Balazs

SYNOPSIS OF BIOLOGICAL DATA ON THE GREEN TURTLE IN THE HAWAIIAN ISLANDS.
George H. Balazs

RADIO TELEMETRY OF HAWAIIAN GREEN TURTLES AT THEIR BREEDING COLONY.
Andrew E. Dizon and George H. Balazs

BASKING BEHAVIOR OF THE HAWAIIAN GREEN TURTLE (CHELONIA MYDAS)
G.C. Whittow and G.H. Balazs

THE THERMAL BIOLOGY OF HAWAIIAN BASKING GREEN TURTLES (CHELONIA MYDAS).
G.C. Whittow and G.H. Balazs

ACROPORA IN HAWAII. PART 1. HISTORY OF THE SCIENTIFIC RECORD, SYSTEMATICS, AND ECOLOGY.
Richard W. Grigg, John W. Wells, and Carden Wallace

ACROPORA IN HAWAII. PART 2. ZOOGEOGRAPHY.
Richard W. Grigg

COMMUNITY STRUCTURE, SUCCESSION AND DEVELOPMENT OF CORAL REEFS IN HAWAII.
Richard W. Grigg

DARWIN POINT: A THRESHOLD FOR ATOLL FORMATION.
Richard W. Grigg

IMPACT OF A KAOLIN CLAY SPILL ON A CORAL REEF IN HAWAII.
S.J. Dollar and R.W. Grigg

UNPUBLISHED PAPERS

THE STATUS AND CONSERVATION OF SEABIRDS IN THE HAWAIIAN ARCHIPELAGO AND JOHNSTON ATOLL.
Craig S. Harrison, Maura B. Naughton, and Stewart I. Fefer

BIOLOGY AND CONSERVATION OF THE LAYSAN DUCK (ANAS LAYSANENSIS)
Daniel W. Moulton and Milton W. Weller

ENCOUNTERS OF HAWAIIAN MONK SEALS WITH FISHING GEAR AT LISIANSKI ISLANDS, 1982.
John R. Henderson

EFFECTS OF TAGGING ON MONK SEAL PUPS; PRELIMINARY RESULTS.
John R. Henderson and Thea C. Johanos

RECOVERY PLAN FOR THE HAWAIIAN MONK SEAL, MONACHUS SCHAUINSLANDI.
William G. Gilmartin

FIRST OBSERVATION OF A FATAL SHARK ATTACK ON A HAWAIIAN MONK SEAL.
Doris J. Alcorn and Alan K.H. Kam

THE HAWAIIAN MONK SEAL, MONACHUS SCHAUINSLANDI, AT FRENCH FRIGATE SHOALS, 1982.
Ruth Ittner

HAWAIIAN MONK SEAL POPULATION RESEARCH, LISIANSKI ISLAND, 1982.
Sheridan H. Stone

SCAT AND SPEW ANALYSIS OF THE HAWAIIAN MONK SEAL, MONACHUS SCHAUINSLANDI.
Rodney T. Watson and Gail A. Peiterson

FECUNDITY OF THE SPINY LOBSTER, PANULIRUS MARGINATUS (QUOY AND GAIMARD), IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Victor A. Honda

DETERMINATION OF SIZE AT MATURITY IN THE HAWAIIAN SPINY LOBSTER, PANULIRUS MARGINATUS, FROM CHANGES IN RELATIVE GROWTH.
James H. Prescott

NOTES ON THE DIETS OF HERBIVOROUS FISHES FROM THE NORTHWESTERN HAWAIIAN ISLANDS.
Lisa H.C. Gouw

FOOD AND FEEDING HABITS OF THE WAHOO, ACANTHOCYCIUM SOLANDRI, IN THE NORTHWESTERN HAWAIIAN ISLAND WATERS.
Steven H. Kramer

AHERMATYPIC SCHLERACTINIA FROM THE HAWAIIAN ISLANDS.
Steven D. Cairns

TRAPPING SURVEYS FOR THE DEEPWATER CHARIDEAN SHRIMPS, HETEROCARPUS LAEVIGATUS AND H. ENSIFER, IN THE NORTHWESTERN HAWAIIAN ISLANDS.
Reginald M. Gooding

GROUNDFISH FISHERIES AND RESEARCH IN THE VICINITY OF SEAMOUNTS IN THE NORTH PACIFIC OCEAN.
Richard N. Uchida and Darryl T. Tagami

CURRENT TRENDS IN HAWAIIAN FISHERIES
Paul N. Shiota and Richard N. Uchida

FISHERY ATLAS OF THE NORTHWESTERN HAWAIIAN ISLANDS.
Richard N. Uchida and James H. Uchiyama

HWN-2-83 Food Habits Studies

A paper entitled "Hawaiian Seabird Feeding Ecology" by Craig Harrison, Thomas Hida, and Michael Seki, was published in the Wildlife Monograph series in October 1983, No. 85. Food habits data were collected from indicator species, black noddies, and red-footed boobies on Tern Island as part of the long-term monitoring effort to assess changes in habitat conditions for seabirds due to man-made or natural causes. These data will also

be used by the National Marine Fisheries Service to assess stocks of prey items and to determine seasonality of prey items and seabird food habits. In 1984, food habits studies were conducted on Tern Island throughout the year, and on Laysan Island during the field camp tenure (March 22 to August 7).

HWN-3-83&84 Seabird Monitoring Studies

A seabird atlas data base was designed for seabird population information on islands in Hawaii, data were input, and a report generated as part of the draft of a Hawaiian Seabird Atlas. Species accounts were also drafted as part of the Atlas.

A detailed manual outlining the program to monitor the health and status of seabird populations in the Northwestern Hawaiian Islands was produced during 1983. Methods to determine populations, phenology, egg size, reproductive success and chick growth rates of seabirds in the Refuge were detailed in the manual. During 1983, population, phenology, food habits, chick growth, and reproductive success data were also collected for black noddies and red-footed boobies on Tern Island, French Frigate Shoals. Population and phenology data were collected by refuge staff during a July-August, 1983, trip to Laysan, Lisianski and Pearl and Hermes Reef aboard the chartered vessel FERESA.

The field camp at Laysan Island. SIF

A field camp was established on Laysan Island on March 22 to August 7, 1984. Wildlife Biologist Fefer and refuge Ecologist Naughton established this camp along with National Marine Fisheries monk seal researchers and refuge cooperators Wayne Gagne and Petra Lenz. Naughton remained in the field camp until July 19, after which she was replaced by Biologist Newman, who continued the studies until August 7 when the field camp was concluded for the year. The purpose of refuge staff participation in the field camp was to collect data on seabirds as part of the seabird monitoring program and to survey endangered species. Populations and phenology surveys of Laysan and black-footed albatross; masked, brown and red-footed boobies; red-tailed tropicbirds; great frigatebirds; and black noddies were conducted. In addition, food habits, reproductive success, egg size, and chick growth studies of black noddies, red-footed boobies, and masked boobies were conducted.

The chartered vessel FERESA departed Honolulu for the HINWR on June 18, landed at each of the refuge islands, and disembarked passengers on Midway Island for return to Honolulu on July 19. Major objectives for the trip included wildlife and habitat surveys at all islands and archaeological surveys at Nihoa and Necker Islands. Shallenberger and Fefer conducted endangered landbird population surveys and seabird population and phenology surveys during the Nihoa and Necker visits. Fefer, Hu, Naughton, and State Biologist Saito continued population surveys of seabirds and endangered species during visits to Laysan and Lisianski Islands and Pearl and Hermes Reef.

The campsite at Necker Island. This site is used because the only level areas on the island are temple platforms (maraes) constructed by ancient Hawaiians which could be damaged by camping activities. SIF

On Tern Island, Refuge Managers Fairaizl and Good, Biological Technician Eilerts, and Biological Volunteers Hanford and Edwards conducted monthly population and phenology surveys of seabirds on Tern Island and semiannual counts of each island of the atoll at French Frigate Shoals. In addition, food habits, egg size, reproductive success, and chick growth studies of black noddies, red-footed boobies, and red-tailed tropicbirds were conducted.

Tern Island Refuge Manager Fairaizl monitoring the red-footed booby colony at Tern Island.

These data have been collected since 1979 and provide a good baseline measure of reproductive parameters. Though breeding populations of seabirds on Tern Island were relatively stable during 1982-1983, subtle differences in the reproductive parameters of black noddies and red-footed boobies noted in 1983 may be attributed to the El Nino event, which markedly reduced seabird populations at Christmas and Jarvis Islands near the equator. Lower black noddy breeding success and lower asymptotic weights of black noddy and red-footed booby fledglings in 1983 may be related to unusual oceanic conditions in the vicinity of the Hawaiian Islands NWR resulting from El Nino.

HWN-4-83 Energetics Modeling

Dr. Ted Pettit, University of Hawaii, completed an energetics model of seabird populations at French Frigate Shoals as part of the contribution of the Sea Grant Program to the NWHI Symposium.

HWN-5-83&84 Golden Plover Study

Golden plovers at Tern Island were observed for behavioral interactions and also color banded as part of a study conducted in cooperation with Dr. Oscar Johnson of Moorehead State University, Moorehead, Minnesota. Dead plovers found on the island were collected and sent to Dr. Johnson for analysis of total body fat content. They were found to be extremely emaciated as compared to plovers that survived the migration.

Dr. Johnson is attempting to determine if the birds are dying as a result of their inability to establish a feeding territory before they starve to death. He has been conducting behavioral and life history studies on this species on Oahu for several years.

This study continued to the end of 1984 with additional collection of dead plovers and the color banding of trapped birds. Study results are not yet available.

HWN-6-83&84 Aerial Survey of Monk Seals

Aerial photographic surveys of all islets at French Frigate Shoals were conducted at 36-day intervals to determine the relative abundance of monk seals in the atoll. Ground truthing was done simultaneously on Tern Island by refuge personnel stationed there. Data from 1983-1984 are presently being analyzed. In addition to obtaining an indication of the relative abundance of seals, the data will enable the determination of seasonal differences in use of the various islets in the atoll, pup production, habitat use, changes in habitat and size structure of the population. The following tables display results of aerial censuses for 1983-84. The figures represent the number of seals counted on photographs and the number of seals counted by a ground observer at the same time the photos were taken.

Thirty-Six Day Monk Seal Photo Census
1983

Date	Tern Island Aerial	Tern Island Ground	All FFS Islets Aerial
Jan. 28	75	88	293
March 5	53	59	294
April 12	28	31	232
May 20	29	53	247
June 22	35	40	296
July 28	52	60	308
Sept. 8	36	38	179
Oct. 12	54	65	254

36-day Monk Seal Photo Census cont.

Nov. 17	58	62	243
Dec. 26	38	62	163

Aerial Monthly Average - 251

Thirty-Six Day Monk Seal Photo Census
1984

Date	Tern Island Aerial	Tern Island Ground	All FFS Islets Aerial
Jan. 27	26	37	182
March 1	57	70	235
April 9	46	58	196
May 18	33	34	215
June 17	34	37	270
July 25	50	56	237
Aug. 31	70	70	313
Oct. 9	57	72	259
Nov. 19	60	104	253
Dec. 23	47	70	263

Aerial Monthly Average - 242

HWN-7-83&84 Hawaiian Monk Seal Study

Ruth Ittner and Gale Fairaizl, volunteers at Tern Island, conducted surveys of Hawaiian monk seal use of Tern Island every four days. Other islets of French Frigate Shoals every 35-38 days (weather permitting) to determine population levels and pup production. They also continued to collect monk seal spewings and scat samples for National Marine Fisheries Service (NMFS). Their work complements a five-year research study that was conducted on Laysan Island until 1981 and other work that is being done by NMFS personnel on a continuing basis (see below).

One of the basic techniques utilized in this study is the identification of individual seals. As of December, 1984 over 280 individuals had been identified and catalogued at French Frigate Shoals on the basis of shark bite scars and other natural markings.

Data from these surveys document a continuing increase in seals using Tern Island. Between July 1979 and December 1984, the

monthly mean of the 4-day seal counts at Tern increased from 5.7 animals to a high of 94.5 animals in November 1984.

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

	1979	1980	1981	1982	1983	1984	MEAN*
Jan.		10.8	29.6	33.9	60.2	49.8	36.9
Feb.		14.2	28.8	31.6	72.5	56.9	40.8
March		24.5	25.9	39.3	59.4	77.3	45.3
April		13.9	28.0	36.9	47.3	49.6	35.1
May		14.9	22.9	28.4	41.0	34.1	28.3
June		16.7	19.6	30.5	36.0	48.6	30.3
July	5.7	17.7	20.7	43.0	41.4	50.9	29.9
Aug.	5.3	21.9	27.3	46.6	53.3	69.4	37.3
Sep.	4.3	19.5	28.3	44.3	46.4	56.9	32.3
Oct.	2.5	23.4	43.4	49.9	61.3	72.1	42.1
Nov.	9.0	22.9	43.5	56.1	68.7	94.5	49.1
Dec.	13.7	33.5	37.5	48.6	67.0	90.6	48.5
Annual Mean		19.5	29.6	40.8	54.5	62.6	

*Mean values are for 1980-1984.

Hawaiian monk seal mother and pup at East Island, French Frigate Shoals.

The highest individual count in the four day interval series was 113 seals on 5 November 1984.

A manuscript addressing movements and reproductive patterns of Hawaiian monk seals at French Frigate Shoals in 1983 was prepared by Gale Fairaizl. Data on productivity and pup bleaching is being analyzed by NMFS researchers.

Refuge staff provided substantial logistical support for NMFS field camps at Necker, Laysan, and Lisianski Islands and Pearl and Hermes Reef in 1983 and 1984. Objectives of these field camps were to conduct population censuses, individually identify seals, estimate seal pup survivorship, tag pups and adult green turtles, monitor seal reproductive behavior, especially "mobbing" of adult females by males, and assess turtle reproductive success. The following sections summarize the NMFS work on monk seal in the NWHI.

1983: Restriction of human activites at Tern Island appears to have a high positive correlation with the increase in use of the beaches of this island by monk seals though a live birth has yet to be recorded. A dead seal fetus was found on Tern Island in January. A female was attending the fetus, but it was not known if the seal "intended" to give birth on the island. East, Whale-Skate, and Trig Islands are preferred by new mothers at French Frigate Shoals.

A female pup was weaned prematurely in May at French Frigate Shoals. NMFS researchers determined the pup would not survive in the wild so it was captured and sent to Marineland in California to determine if these extremely underdeveloped pups could be reared in captivity. The pup died about one month later because of difficulties ingesting food.

A juvenile male was captured on Laysan Island in August by NMFS researchers and transported to the Waikiki Aquarium in Honolulu. The seal is healthy and well and is presently being used for behavioral studies.

Eight juvenile seals were found dead at French Frigate Shoals during the year. All appeared to have died of natural causes.

An adult male bleach marked "S-33" was observed on Tern Island during the last three months of the year. This animal was first marked in the summer of 1982 at Lisianski by NMFS researchers and again at Laysan in the summer of 1983.

1984: A field camp was established at Southeast Island on Pearl and Hermes Reef from July 3 to August 5; personnel present were Robert Morrow and Sheila Conant. During this time they conducted censuses, tagged seal pups, and searched for pups tagged during the previous year. Sixteen pups were born at Pearl and Hermes Reef in 1984, of which 13 were tagged. Of 10 pups tagged at Pearl and Hermes in 1983, 6 (60%) were sighted. Also sighted was a male seal tagged at Kure as a pup in 1981.

Doris Alcorn and Robert Forsyth were present on Lisianski Island from July 2 to August 6, during which time they conducted censuses on alternate days, patrolled the island perimeter daily, searched for tagged seals, and tagged pups of the year. Only 15 pups were sighted and tagged, a considerable decline from the 24 of the previous year. It is possible that some pups were missed due to the late dates of the field camp, though coverage of the island was thorough and extensive. Of the 24 pups tagged at Lisianski in 1983, 21 (88%) were sighted, and 10 of the 13 pups tagged in 1982 were sighted. Net fragments and other debris considered hazardous to seals was cataloged, sampled, and burned.

A field camp was established on Laysan Island from May 29 to August 7. Present during that time were Robert Forsyth, Thea Johanos, and Alan Kam. Throughout the spring and summer, behavior of adult and, in particular, subadult male seals was observed and recorded as part of an effort to identify behavioral profiles of seals which participate in mass attacks or "mobbings" on other individuals. No mobbing incidents were observed, although several instances of "harassment" of females and pups by adult males were observed.

Previously tagged seals were re-sighted, as were animals marked in 1983. Of the 20 pups tagged in 1983, 18 (90%) were sighted on Laysan in 1984. Also resighted was a juvenile which had been tagged as a pup on Lisianski in 1983. Twenty-nine pups were tagged on Laysan in 1984. Also tagged was one adult male seal which had been identified as participating in harassment incidents.

There were three documented seal mortalities, a subadult male which sustained injuries from an apparent mobbing, an adult female which died of unknown cause, and a newborn pup which died the day of its birth. Tissue and skeletal samples from all three animals were collected.

NMFS personnel were present at French Frigate Shoals from March 7 to August 31. Conducting the research were Julie Eliason, John Henderson, Gary Barone, George Balazs, Alan Kam, Susan Lautenslager (FWS volunteer), Robert Morrow, and Thea Johanos. Temporary field camps were established on Whale-Skate and East Islands, and censuses were conducted at remote islets throughout the Shoals as weather permitted. Pups marked in 1983 were observed throughout the field season , and a total of 91 pups born in 1984 were tagged. Parturient females were identified as part of an ongoing project to establish pupping histories of individual animals. Scat samples were collected for food habits research, and to assess the feasibility of detecting pregnancy in females according to hormones excreted in the feces.

Four pups and three juvenile seals were found dead at FFS during the year. All appeared to have died from natural causes. One of the deaths was a still-born pup found on Tern Island. A live birth has never been recorded at Tern Island. This likely due

to the fact that the nearshore habitat is less protected at Tern and, therefore, unsuitable as a nursery area for young pups.

Robert Morrow visited Necker June 20-28 and Doris Alcorn went ashore for a single day on August 5. At these times they conducted censuses and searched for tagged or marked seals. Noteworthy are three sightings of yearling seals born and marked in 1983 at French Frigate Shoals.

Refuge Manager Shallenberger and Wildlife Biologist Fefer visited Nihoa Island on June 22. Twelve seals were seen on the NW beach including 4 adults, 6 subadults, and 2 juveniles. There was no evidence of bleach marks or tags on any of these animals. No pregnant females were observed. One juvenile had an obvious head scar.

Previous NMFS studies indicated that the monk seal population at Kure Atoll had been characterized by a very low reproductive rate the past several years. In an attempt to reverse this trend, a transplanting project was begun in 1984. Six prematurely weaned pups, that normally do not survive in the wild, were captured at French Frigate Shoals and transported to the Waikiki Aquarium in Honolulu. One female died at the aquarium, leaving three females and two males. One male was taken to Kure Atoll in late July. Soon thereafter, the Monk Seal Recovery Team recommended screening all transplants for diseases and/or genetic weaknesses, and not introducing males, which could possibly increase the already imbalanced sex ratio at Kure. The females will be relocated to Kure in the early summer of 1985. The male will be kept in captivity at the Waikiki Aquarium.

Nine male seals which had been implicated in mobbing attacks on females were translocated from Laysan to Johnston Atoll NWR. Biologist Fefer observed and accompanied the transport aboard the TOWNSEND CROMWELL.

An attempt is made by NMFS to tag as many pups each year as possible. Logistic and economic constraints prohibit monitoring of seal pupping during the entire season at all islands, but an attempt is made to be present during peak pupping periods. The following table displays observed monk seal pupping from 1982-84 as a result of NMFS field camps and short visits by refuge personnel.

HINWR MONK SEAL PUP PRODUCTION
1982-1984

LOCATION	1982	1983	1984
Pearl and Hermes Reef	9	12	16
Lisianski Island	28	25	15

HINWR Monk Seal Pup Production cont.

LOCATION	1982	1983	1984
Laysan Island	30	24	29
French Frigate Shoals	92	94	91
Necker Island	4	3	0
Nihoa Island	1	0	0
Totals	170	158	151

HWN-8-83&84 Green Turtle Study

NMFS Biologist George Balazs along with several assistants monitored nesting turtles on East and Whale-Skate Islands, French Frigate Shoals, during June, July, and August of both years. This is the first time that concurrent monitoring on more than one island has been undertaken. Of particular interest is that several individual turtles were seen making excavations on both Tern and Whale-Skate Islands. There appears to have been a relatively high number of turtles nesting in 1984, particularly in comparison with 1983, a "low" year.

Adult turtles were tagged during both years and there was a large effort to tag hatchling turtles in 1984. Both tagging schemes are reported under the Marking and Banding section below.

A report, "Recovery of Adult Green Turtles Observed or Originally Tagged at French Frigate Shoals, Northwestern Hawaiian Islands", by George Balazs was published as a U.S. National Marine Fisheries Service Technical Memorandum (SWFC-36) in August, 1983.

HWN-9-83 Productivity of Coral Reefs

Dr. Richard Grigg of the Hawaii Institute of Marine Biology, University of Hawaii, completed studies of primary and secondary productivity at French Frigate Shoals during 1983. Grigg and two assistants, Bob Howerton and Robert Cisneros, collected data at the Shoals from January 6-9 and March 4-7, 1983. The results of the field work were reported at the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands held at the University of Hawaii in May, 1983.

HWN-10-83&84 Lobster Study

Dr. Craig MacDonald of the University of Hawaii studied the life history, growth and production of two species of lobsters in the

NWHI. He hopes to generalize the results from French Frigate Shoals and Kure Atoll to management of the spiny lobster fishery in the NWHI.

MacDonald and his assistants conducted field work at French Frigate Shoals during June of 1983. Part of his study included the collection of larval lobsters throughout the year. Tern Island personnel assisted MacDonald by tending larvae collectors installed between Tern and Trig Islands. Results were presented at the Second Symposium on Resource Investigations in the NWHI held in May, 1983.

Monthly lobster larvae collection continued thru 1984 with Tern Island Refuge Manager Fairaizl and volunteer Gale Fairaizl completing the bulk of the work. Data are being used to develop a population recruitment survey technique.

HWN-11-83 Fish Trophic Studies

Tony Sudekum and Tom Mirenda continued to monitor fish populations and remove picivorous fish from experimental reefs near Whale-Skate Island at French Frigate Shoals. A request to use rotenone during the completion of this study was received from principle investigator Dr. James Parrish of the Hawaii Cooperative Fisheries Unit. Necessary Section 7 consultations and other permit applications were performed or prepared for this aspect of the study. Dr. Parrish and his team collected fish at FFS from March 18-28. Results were presented in the Second Symposium on Resource Investigations in the Northwestern Hawaiian Islands.

HWN-12-83 Life Histories of Fish

Tony Sudekum collected specimens of the carangids Caranx ignobilis and C. melampygus at French Frigate Shoals to get information on the life history of these species. Other species collected during the fish trophic studies were also used in life history studies. Results were presented at the Second Symposium on Resource Investigations in the NWHI.

HWN-13-83 Seabird Visual Sensitivity

Jonathan Reed and assistant, Janet Smith, tested the following birds at French Frigate Shoals for visual sensitivity to various light frequencies: 20 Bonin petrels, 7 Laysan albatross, 4 black-footed albatross, 8 red-footed boobies, 10 white terns, 10 black noddies, and 9 brown noddies. The light frequencies tested included ultraviolet, visible and infrared. Reed concluded that the endangered Newell's shearwater and dark-rumped petrel tested on Kauai have strong sensitivity to ultraviolet wavelengths of light. The closely related Bonin petrel tested at Tern Island showed little sensitivity to these wavelengths.

These scotopic (night-sensitivity) data suggest possible management applications to decrease the detectability of lights at a distance by night-flying birds. High mortalities have occurred after seabirds were disoriented by lights. Two management tools are suggested by the data, especially relating to the endangered seabirds breeding on the main Hawaiian islands. First, elimination of ultraviolet wavelengths in lights would decrease the apparent brightness of light to UV-sensitive birds while not altering the apparent brightness to UV-insensitive humans. Second, the long wavelength component may decrease attractiveness to the species of interest. Data from this study are presently being analyzed and will be part of a Ph.D. thesis in Zoology at the University of Wisconsin by Johnathan Reed.

HWN-14-83 Nihoa Finch and Millerbird Study

Dr. Sheila Conant of the University of Hawaii completed a study of the ecological requirements of the Nihoa millerbird and the Nihoa finch, including an analysis of management options for the millerbird. In April, 1983, Dr. Conant travelled to Nihoa Island to continue her studies of the Nihoa finch and Nihoa millerbird. The following papers were published as a result of the investigation:

Conant S. and D. Herbst. 1983. A Record Nephrolepis multiflora from Nihoa Island, Northwestern Hawaiian Islands. Newsl. Hawaiian Bot. Soc. 22:17-19.

Gagne, W.C. and S. Conant. 1983. Nihoa: Biological Gem of the Northwest Hawaiian Islands. Ka'Elele, Vol. 10, No. 7.

Conant, S. 1983. Observations of Migrant and Vagrant Birds on Nihoa Island. Elepaio 44:23-25.

HWN-15-83 Invertebrate survey on Nihoa Island

Dr. Wayne Gagne of the Bishop Museum travelled to Nihoa Island in April, 1983, to conduct invertebrate surveys. Ten days of collecting effort on Nihoa yielded over 50 new records of arthropods, including at least 6 new species that are probably endemic to Nihoa. These data underscore the need for further research on the endemic terrestrial arthropods of the NWHI.

HWN-16-83&84 Weather Data Collection

Weather data are continually broadcast from a remote weather station on Tern Island as part of a satellite system, RAMOS, used by NOAA to predict weather patterns. Tern Island personnel assist in the maintenance of the weather station and also collect daily information on temperature, wind speed and direction, cloud cover and barometric pressure.

HWN-17-83&84 Tide Data Collection

A continually recording tide gauge is maintained at Tern Island for the Hawaii Institute of Geophysics, University of Hawaii. FWS personnel take daily readings and adjust the gauge periodically. Data from this station are made available to scientists at UH who are studying tidal and sea level fluctuations throughout the Pacific Ocean.

HWN-18-84 Hawaiian Undersea Research Laboratory (HURL) Submarine Survey

The HURL conducted field studies at French Frigate Shoals and Necker Island September 8-30, 1984. The objective of this project was to provide submersible support for the investigations of ferromanganese crusts and benthic flora and fauna at nine study sites around FFS and three at Necker, in order to address national, state, and commercial concerns regarding the environmental impact of ferromanganese crust mining.

HWN-19-84 Laysan Finch Study - Pearl and Hermes Reef

Dr. Sheila Conant participated in a National Marine Fisheries Service field camp at Pearl and Hermes Reef during the summer of 1984. During her stay on the islands she conducted population surveys of finches on the islands of this atoll. She also banded finches and began a study of the morphometry of these finches as compared to the Laysan finches on Laysan Island. The finches on Pearl and Hermes were introduced to this atoll from Laysan island in 1967 in hopes of establishing an additional population in case the Laysan Island population became extinct. Dr. Conant began a study of these finches to determine if any differences have developed within the finch population at Pearl and Hermes since this introduction.

HWN-20-84 Vegetation Study - Pearl and Hermes Reef and Necker Island

During a brief visit to Necker Island and participation in a field camp at Pearl and Hermes Reef, Dr. Sheila Conant conducted surveys of vegetation in each of these areas and provided a report on her findings.

HWN-21-84 Biological Investigations of Laysan's Hypersaline Lake and Related Aspects

Drs. Wayne Gagne and Petra Lenz traveled to Laysan Island during the year to study the Laysan hypersaline lake especially as it relates to the ecology of the Laysan duck. Dr. Lenz studied the bathymetry of the lake as well as other physical and chemical characteristics. A baseline of information on the status of the

Laysan lake was developed during this study and included information on the lake's physical characteristics, salinity, temperature, dissolved oxygen, and brine shrimp population. Dr. Gagne's research on the Laysan lake emphasized the life history of the brine fly (Neoscatella sexnotata). An objective of Dr. Gagne's work was to develop a sampling program for the brine fly so that the refuge could monitor fly population fluctuations. The brine fly is a very important food of the Laysan duck, especially during the duck's breeding season. The survival of the Laysan duck appears contingent upon a healthy brine fly population at the Laysan lake.

Laysan duck feeding on brine flies along the shore of the lagoon at Laysan Island. SIF

HWN-22-84 Remote Sensing of Vegetation on Laysan Island

Audrey Newman conducted surveys to monitor vegetation on Laysan Island and to develop vegetation maps for Laysan from aerial photographs taken in May, 1984.

E. ADMINISTRATION

2. Youth Programs

1983: Two students from Kamehameha High School in Honolulu were hired for the Tern Island YCC summer program. This was an experimental year for the YCC program on Tern Island to determine if high school students could adapt to life at the remote field station, and to see if they could accomplish enough during their short period of service to make the program cost effective. The program was deemed a great success and it was recommended that the Tern Island YCC Program continue in future years. During their four weeks on island, the YCC students spot-painted the diesel storage tanks and did other miscellaneous jobs in addition to assisting with biological studies including seal surveys, turtle tagging, seabird reproductive success studies and collecting food samples from seabirds.

1984: A YCC program was conducted at Tern Island from June 12 to July 25. Two high school students, Kevin Sasaki and Mark Borello, participated. Their main job was to paint the barracks. They also assisted in reproductive success studies for five species of seabirds, 4-day seal surveys, capturing seal pups for the NMFS headstart program, tagging seal pups and turtles, and collecting seabird food samples. Again, the program was very successful.

4. Volunteer Program

1983: A number of volunteers spent considerable time at Tern Island this year. Ruth Ittner and Gale Fairaizl provided general assistance to staff and visiting researchers in addition to collecting data on monk seals. Cathy Good also provided general assistance. Jonathan Reed, Janet Smith, Peter Pyle, Bruce Eilerts, Scott Johnston and Robin Hanford provided valuable assistance with ongoing seabird research projects. Sue Lautenschlager assisted with seal and turtle research.

Dr. Wayne Gagne of the Bishop Museum in Honolulu and Dr. Sheila Conant of the University of Hawaii participated as volunteers in the July/August field trip to Laysan, Lisianski, and Midway Islands and Pearl and Hermes Reef. They conducted plant surveys (Conant) and entomological surveys (Gagne) and assisted Biologist Fefer with endangered bird surveys.

1984: Volunteer Biologists Gale Fairaizl, Robin Hanford, and Scott Edwards participated in seabird monitoring studies on Tern Island and were instrumental in the successful completion of biological studies at this field station. Gale also conducted 4-day seal surveys and provided general assistance to staff and visitors. Sue Lautenschlager participated in turtle tagging and other research.

6. Safety

1983: Runway lights at Tern Island were repaired and a spotlight was installed under the wind sock to facilitate night landings.

Dr. Ken Nakasone, Honolulu Medical Group, was retained as a medical advisor for Tern Island and the remote field camps. His primary function was to provide prescription drugs and medical and first aid advice to Tern Island and the camps via radio. He also advised what drugs and first aid supplies should be kept on hand at Tern Island and provided physician services to Tern Island personnel when they were in Honolulu.

Plastic flags were installed on the east end of the runway in March to discourage sooty tern nesting. They functioned well though some maintenance was required to repair wind damage.

Normal safety precautions were taken for all plane and boat arrivals and departures.

No serious accidents occurred on the Refuge during the year.

1984: Halon fire extinguishers, fuel filters and other items recommended by OAS were purchased to bring the Tern Island aircraft refueling operations up to the proper standards. Additional fire extinguishers were purchased to improve the fire protection system at Tern island. Dr. Nakasone continued to provide medical advice and assistance whenever an illness or injury occurred at Tern Island. He travelled to the island in December to inventory and recommend items for restocking the medical supply cabinet and to assess the general health of resident personnel.

The seat of the newly purchased ATV (Heald Hauler Model HH-1216) caught fire October 30 about five minutes after the ignition was turned off. Only minor damage was incurred to the rest of the cart. The cause of the fire could not be determined. The cart received extensive use through the remainder of the year with no further problems.

Plastic flags were again constructed and installed to prevent sooty tern nesting on runway aprons.

7. Technical Assistance

Refuge staff provided advice on mechanical repair work to the NMFS field camps and several fishing boats. Numerous radio messages were passed to Honolulu from Tern Island requesting assistance for fishermen in the area. The staff also assisted in the collection of masked boobies during 1984 for the Sea Life Park remote island exhibit as described under this section in the Complex Narrative.

8. Other

Assistant Secretary Arnett and Director Jantzen participated in the Tripartite Symposium on Research Investigations in the Northwestern Hawaiian Islands, May 25-27, 1983, after a briefing trip to Tern Island on May 23-24.

FWS Director Robert Jantzen and friend on Tern Island.

F. HABITAT MANAGEMENT

1. General

Refuge staff continued to take photographs used for evaluation of habitat condition, production of documents, public lectures, and information for visiting researchers.

Refuge staff conducted an aerial photography mission over Laysan on May 26, 1984, using the Hawaiian Sky Tours aircraft. The flight originated at Honolulu and used Tern Island as a refueling base. Service and NMFS-owned Hasselblad 70mm cameras were used for true-color and infrared phtography. The film was printed and will be used as a basis for vegetation mapping. Audrey Newman was on Laysan Island to survey vegetation and ground-truth the aerial photography in July and August, 1984.

2. Wetlands

Drs. Wayne Gagne and Petra Lenz conducted physical and biological studies relative to the hypersaline lake at Laysan Island during the 1984 field camp. The studies are described above under HWN-21-84 of the Research and Investigations section. The lake supports the entire population of the endangered Laysan duck, substantial populations of shorebirds and a few migratory waterfowl.

6. Other Habitats

1983: Land management practices at Tern Island included efforts to keep the landing strip free of nesting birds and repairing damage to the island caused by heavy rain and wave erosion. The west end of the landing strip was landscaped to prevent seabirds from nesting there. Vegetation was removed from the east end of the runway for the same reason. The filling of erosion-caused holes between the seawall and the island has prevented endangered monk seals from falling in and becoming injured or trapped.

1984: Based on aerial and ground surveys conducted by refuge staff during the past 4 years, it was noted that vegetation on the central eastern portion of Laysan Island had died due to unknown factors. As a result of this devegetation, sand was now blowing or drifting into the central lagoon on Laysan Island, which is a critical habitat for the endangered Laysan duck. It was also noted that the freshwater seep areas on this shoreline of the central lagoon were being filled with sand. These freshwater areas are very critical to the Laysan duck as they are the only areas of fresh water at certain times of the year. A lack of available freshwater on the island could result in a serious problem for the Laysan duck.

As a result of these observations, an emergency action to stabilize the sand dunes was discussed at the Endangered Species Program evaluation of refuge operations in May. Soon thereafter, we acquired fencing material and fumigated this material to ensure that insects and plant seeds that may be associated with the fencing material were not introduced to Laysan Island.

Drift fence was erected across a blowout at Laysan Island to prevent blowing sand from filling the lagoon, thereby damaging Laysan duck and migratory shorebird habitat. SIF

In November, Biologist Fefer, Biological Technician Eilerts, Resident Biologist Jacobi, Volunteer Peter Pyle, Maintenance Worker Kip Bottomley and State personnel Matthew Higashida and William Stormont traveled to Laysan to construct a drift fence on the central eastern shore to reduce the drifting sand filling the lagoon. Approximately 640 feet of fence was constructed in two lines approximately 60 and 250 feet from the lagoon shore. In addition, endangered species (Laysan finch and Laysan duck) and migratory shorebird populations were surveyed and at-sea observations of pelagic seabirds were conducted aboard the FERESA and TOWNSEND CROMWELL.

10. Pest Control

Wildlife Biologist Fefer prepared a draft of the exotic mammal detection/control contingency plan for the Refuge in 1983.

In April 1984 over 1500 sooty tern eggs were destroyed on the ends of the runway at Tern Island, to accomodate safe landing and departure of aircraft. Constant harassment of sooty terns by placing flags at ends of the runway proved somewhat effective in the early part of this period, but less effective as increasing numbers of terns sought out suitable nesting sites.

During visits to refuge islands, biologists investigated the

status and extent of alien plant and animal species.

Plastic flags were erected at the ends of the runway at Tern Island to discourage sooty terns from nesting in the flight path. SDF

12. Wilderness and Special Areas

All areas within the Hawaiian Islands NWR, with the exception of Tern Island and the dredged area around it, were designated as Research Natural Areas in 1967. All of the Tripartite studies conducted in inshore areas fell within the realm of activities sanctioned by this designation. Many of these studies were also geared to determining the effects of a commercial activity (fishing) on the natural resources within the Refuge/Research Natural Area.

A formal proposal for designation of the entire Hawaiian Islands NWR (exclusive of Tern Island) as Wilderness was submitted by the FWS in 1969. In response to considerable local opposition, the proposal was modified to include only the emergent lands, again exclusive of Tern Island. Though the proposal has not been acted on by Congress, the refuge has been managed as defacto Wilderness since 1969.

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 the preceeding research sections. 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 (SUP's). 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 SUP's 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 speces 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.

1983: The Marine Mammal Commission met in Honolulu on Feb 24-26. Included on the agenda was nearly an entire day devoted to the Hawaiian Monk Seal. Complex Manager Shallenberger and PIA Coggeshall provided the portion of the program relating to FWS research and management activities pertaining to monk seals. Other representatives of NMFS and the State provided additional information. Discussion focused on past and future research and management programs, impacts of ongoing and anticipated human activities, information/education programs, and related topics. Tern Island was of particular interest to the commissioners and to the members of the scientific advisory committee. Six members of this group were able to visit Tern Island for an overnight visit on the weekend.

Wildlife Biologist Fefer conducted population counts of Laysan ducks and Laysan finches during the July/August trip to Laysan Island using monitoring methods developed by John Sincock. Populations of Laysan finches were found to be at carrying capacity estimated for the island by Sincock. Laysan ducks are very difficult to survey during July/August as many birds are under cover in molt. Thus, population estimates were very low.

1984: Wildlife Biologist Fefer and Complex Manager Shallenberger conducted population surveys of Nihoa finches and Nihoa millerbirds during an expedition to Nihoa Island June 21 to 27. Nihoa finches were found to be abundant throughout the island. The standard finch survey was conducted using transects. On transect, finches were sometimes seen in groups of 7-8 birds. Much variation in plumage was noted. No active nests were

observed although juvenile birds were present. Two finch nests were collected. Finches were observed preying on brown noddy and Bulwer's petrel eggs. Transect work resulted in an estimate of 3,765 Nihoa finches. Estimates of finches on Nihoa in earlier years using the same survey methods ranged from 1318 to 6686. In 1979, an estimate of the finch population was 3612. Thus, the finch population is apparently relatively stable. One banded male finch was observed in the vicinity of the refuge sign with a red band on its left leg.

Nihoa millerbird surveys were conducted using transects at the same time as the Nihoa finch survey. This survey indicated a population of 437 birds. Recent (1977-79) millerbird estimates using the same methods range from 127-490. One banded millerbird was observed 20-50 feet behind the sign with two red bands on the left leg and one silver band on its right. Millerbirds are highly secretive. They were observed at the base of vegetation, particularly Chenopodium. Millerbirds are very methodical in their feeding behavior, picking up small insects under sticks or litter. One was observed feeding on flies on a bird carcass. Birds were not disturbed by observers, but maintained a distance of 6-10 feet.

On Laysan Island, Laysan finch surveys were conducted in November using the standard transect method. The total population estimate derived from this survey was 18,253 finches. The population of this species on Laysan Island appears stable.

On Pearl and Hermes Reef, Laysan finch surveys were conducted by refuge cooperators and volunteer Sheila Conant. Standard transect surveys were conducted during July and August. Population estimates of the Laysan finch on the islands of Pearl and Hermes Reef are in the following table:

RESULTS OF 1984 LAYSAN FINCH SURVEY ON PEARL AND HERMES REEF

Island	Birds
Southeast	513
North	152
Grass	31
Seal Kittery	41
TOTAL	737

Since introduction of 108 Laysan finches on Southeast Island, and Pearl and Hermes Reef in 1967, the population has grown steadily and appears to have reached a stable carrying capacity.

Laysan ducks were censused on Laysan Island via a total count of ducks observed around the lagoon during crepuscular hours. This census was conducted weekly from March 29 to August 7. A maximum of 150 ducks (adults and juveniles) were observed during one survey. This estimate is relatively low when compared to counts conducted in previous years. It is difficult to provide a total population estimate based on lagoon counts, but these counts do indicate general trends in populations if conducted throughout the season.

Chicks were present when we arrived on the island in March. This was the earliest that ducklings have ever been recorded. At least 10 ducklings were present in early April; 6 had eggs and one had unknown contents. In 1984, there were two fairly distinct peaks of breeding. Chicks were present when we first arrived in March; in June, Class I chicks appeared for the second time. Birds were seen copulating on May 12 and "dumped" eggs were found along the lagoon edge in mid-June.

3. Waterfowl

The general lack of suitable habitat for waterfowl and the distance from major waterfowl migratory routes accounts for the rarity of these species within this refuge. The only resident waterfowl is an endemic and endangered species, the Laysan duck, which inhabits a hypersaline pond on Laysan Island. A study of this species is described above.

1983: A coot was captured and banded at Tern Island in July. It was found dead at Tern Island a month later. A second coot was observed at Tern during the last three months of the year. It, too, was banded.

Wildlife Biologist Fefer noted 4 coots present in the hypersaline lake at Laysan Island during late July.

An unidentified duck was observed at Tern Island in February. Three American widgeons were also seen there.

1984: Four pintails were seen October 15-18, a greater scaup was observed November 16-19, and a single coot was observed January 1-13 at Tern Island.

During a visit to Laysan Island in November, Biological Technician Eilerts and Volunteer Biologist Peter Pyle observed nine pintails and five green-winged teal. Four coots were observed at Laysan in early April.

5. Shorebirds, Gulls, Terns and Allied Species

Migratory seabirds are emphasized in the management and research programs of the Hawaiian Islands NWR. During 1983, additional information was collected and analyzed on the breeding biology and ecology of the 19 species of seabirds that utilize the islands for nesting (see HWN-1, HWN-2, and HWN-3 above). Studies included estimation of population levels and determination of phenology, breeding success, chick growth rates, incubation periods, and food habits. Additional knowledge of the baseline status and variability of these parameters will prove useful for monitoring the future status of the resources.

Laysan albatross chick with feet elevated as a temperature control mechanism. RCW

The first successful great frigatebird nest was recorded on Tern Island in 1983. A lesser frigatebird was observed on Tern Island August 2. A black-footed X Laysan albatross hybrid was observed incubating an egg from November 30 through the end of the year.

This is probably the same bird observed incubating in 1982. The 1982 nest failed.

Non-breeding birds of this category observed at French Frigate Shoals include cattle egrets, a glaucous winged gull, a sharp-tailed sandpiper, ruddy turnstones, golden plovers, wandering tattlers, bristle-thighed curlews, a dowitcher, a dunlin and a black-bellied plover.

On Laysan Island Wildlife Biologist Fefer recorded a California gull in late July, 1984, as well as a semi-palmated plover.

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 following tables:

TOTAL NUMBER OF NESTS ESTIMATED FOR TERN ISLAND
1983-1984

Species	1983	1984
Black-footed albatross	193	221
Laysan albatross	852	854
Red-tailed tropicbird	201	308
Red-footed booby	404	629
Great frigatebird	1	0
Gray-backed tern	56	48
Sooty tern	12,500	13,000
Brown noddy	921	927
Black noddy	726	615
White tern	34	34
TOTAL	15,888	16,636

FFS Atoll-Wide Nest Counts
1983-1984

Species	1983		1984	
	12/83[1]	5/83[2]	3/84[3]	6/84[4]
Black-footed albatross	4,561	2,471	2,490*	2,769
Laysan albatross	1.985	1,062	1,109*	901
Red-tailed tropicbird	1	311	163	327
Masked booby	1	354	380	337
Red-footed booby	0	521	540	611
Great frigatebird	7	383	470	308
Gray-backed tern	0	56	72	50
Sooty tern	0	14,700	9,879	0
Brown noddy	0	1,447	857	1,407
Black noddy	0	439	461	197
White tern	2	27	18	20
TOTAL	6,557	21,771	16,439	6,749

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

[2]Includes: Tern, Trig, Whale-skate, East, Gin, Little Gin, Disappearing and Shark Islands.

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

[4]Includes: Tern, Trig, Whale,skate, East, and Little Gin Islands.

*Whale-skate not censused for albatross.

An estimate of the current numbers of breeding pairs and their distribution for the entire northwestern Hawaiian chain is presented in Table 1 (following pages).

During November, 1984, Peter Pyle and Bruce Eilerts conducted pelagic seabird observations enroute to Laysan Island and during the return trip to Tern Island. In addition to the usual species seen in this area, the following observations were made:

1. White-necked Petrel (Pterodroma externa). Four of this species were observed on November 3 between Midway and Laysan, and one was recorded about 16 km west-northwest of French Frigate Shoals on November 16.

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
TOTAL	235,115	52,725	98,155	5,315	943,760

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				
	Lisianski Island	Pearl and Hermes Reef	Midway Islands	Kure Atoll	Total
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	10,000 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
TOTAL	953,575	84,255	278,835	22,025	3,673,759

2. Kermadec Petrel (Pterodroma neglecta). We identified a single, dark-phased individual of this species on November 3 at 27 03'N 174 42'W.

3. Cook's Petrel (Pterodroma cookii). We recorded 5 Cook's petrels on November 3 (2), 4 (2), and 15 (1). Extremes in location were 27 18'N 175 16'W and 24 41'N 169 09'W. These are the first reports of this species in Hawaiian waters. Records from Alaska and California, however, establish this New Zealand species as ranging in North Pacific waters, so it is not unexpected in the Hawaiian Island area.

4. Buller's Shearwater (Puffinus bulleri). Two individuals of this species were observed on November 3, both in the vicinity of 27 21'N 175 20'W.

5. Short-tailed Shearwater (Puffinus tenuirostris). Pyle watched an individual of this species following the boat for several minutes on November 3 at 27 27'N 175 34'W.

6. Wilson's Storm Petrel (Oceanites oceanicus). We carefully identified 3 individuals of this species on November 3 in the vicinity of 27 10'N 174 58'W. These are the first records of this species in Hawaiian waters. It is a southern hemisphere breeder with a major northward range extension into the North Atlantic Ocean and a small and little understood extension into the North Pacific. Records for the Eniwetok area, Japan, and California indicate the potential for its regular occurrence in Hawaiian waters.

7. Leach's Storm Petrel (Oceanodroma leucorhoa). Four Leach's storm petrels were observed on November 3 (2), 4, and 14.

Shorebirds were censused two times on Laysan Island in 1984. Ecologist Naughton was present on the island from April to July, and biological Technician Eilerts and Volunteer Biologist Pyle were present in November. The following table displays peak numbers of each species for the two periods:

HIGH COUNTS OF MIGRATORY SHOREBIRDS
ON LAYSAN ISLAND, 1984

Species	April-July	November
Ruddy Turnstone	2,255	4,500
Lesser Golden Plover	2,843	2,600
Sanderline	4	25
Wandering tattler	178	400
Bristle-thighed curlew	165	125
Ruff	0	2
Dunlin	1	1
Sharp-tailed sandpiper	0	11
Pectoral sandpiper	0	1
Bar-tailed Godwit	2	3
Lesser yellowlegs	1	1
Long-billed dowitcher	0	2
Short-billed dowitcher	0	1

The following table shows numbers of migratory shorebirds seen on refuge islands during short trips in the summer of 1984:

Species	Nihoa 6/21-27	Necker 6/21-27	Lisianski 7/11-14	Pearl & Hermes Reef 7/15-17
Ruddy turnstone	8	4	100	3
Lesser golden plover	4	1		8
Wandering tattler	1	0	5	1
Bristle-thighed curlew	0	1	50-75	12

6. Raptors

1983: An adult male Stellers sea eagle was observed on Tern Island November 4-12. The bird was first noticed roosting in the rigging of a fishing vessel anchored in the lagoon at French Frigate Shoals. Two days later it was seen on the Tern Island boat hoist and later atop the telephone pole which is the tallest structure on the island. A short-eared owl was sighted on Tern island during the last few days of December.

1984: A short-eared owl was observed at Tern Island January 1 to April 15. Two others were sighted March 16-31. Additional owl sightings occurred November 28-30. A peregrine falcon was observed at Tern Island November 16-24.

7. Other Migratory Birds

A mockingbird was observed on Tern Island from January through April, 1983, and on Necker Island in late June, 1984.

9. Marine Mammals

Pods of spinner and bottlenose porpoises and humpback and pilot whales were observed at French Frigate Shoals and other islands within the refuge.

11. Fisheries Resources

Results of fishery surveys and other fishery research conducted within the refuge are reported in the research section (see HWN-9, HWN-10, HWN-11, and HWN-12).

Information which emphasized the prohibition of trespass on the refuge and the offer to assist with communication and emergency situations through the Tern Island field station was distributed to fishermen.

Special effort was made to foster cooperative relationships with NWHI fishermen. Examples include: The medivac of a fisherman with a badly cut finger off the vessel KAIMI from Tern Island to Honolulu in February, 1983, and the medivac to Honolulu of an injured fisherman off the vessel ELLIE B in December, 1983. The following vessels provided free transportation of supplies and equipment to and from the Tern Island field station: EASY RIDER, ELLIE B, FERESA, NIGHTINGALE, DAY STAR, DRAKKAR, 4-SEAS, TOWNSEND CROMWELL, and KILA.

A Special Use Permit was given Mr. Gary Naftel to install an emergency mooring buoy 1 1/4 miles south of Tern Island. The buoy was anchored at a depth of 39 ft. in sheltered waters within the refuge boundary and is to be used only in defined emergencies including hazardous weather, serious vessel operational problems, and illness or injury of a crew member. Its use is subject to prior verbal approval over the radio by the Assistant Refuge Manager at Tern Island. Use is further governed by a rigid set of restrictions designed to protect fish and wildlife resources and their habitat.

Considerable staff time was spent reviewing and discussing the State of Hawaii's proposal for a multi-resource fishery support base at French Frigate Shoals. The State envisions a two-phase fishing trip scenario utilizing a variety of gear to target

several species. Fishes suitable for the frozen market would be caught by vessels outward bound from Honolulu to the NWHI and unloaded at a mothership/barge which will store the frozen catch for transshipment to Honolulu and provide supplies, fuel, and provisions for the catcher boats. Species for the fresh fish market will be targeted by catcher vessels during their return trip to Honolulu. The mothership would be anchored near Tern Island with the island serving as a recreational area for fishing crews, for gear storage, and for emergency evacuations. An extensive list of comments on the proposal was provided to the State. It was also recommended that the proposal be considered as an option in the Master Planning process and thereby examined in the context of systematic planning for the refuge as a whole. This was subsequently done.

The State's proposal to establish an albacore fishery support base at Midway was also examined in considerable detail. FWS comments were generally supportive. Neither of the two proposed bases are being actively promoted by the State at present.

14. Scientific Collections

Dead golden plovers salvaged at Tern Island were sent to Dr. Oscar Johnson, Moorehead State University, for analysis of total body fat content.

Lobster larvae at French Frigate Shoals were collected by and for Dr. Craig McDonald, University of Hawaii, as part of his effort to determine population biology and life history parameters of spiny lobsters within the Hawaiian Archipelago.

Extensive collections of inshore fishes were made at French Frigate Shoals by Dr. James Parrish, University of Hawaii, and his students Tony Sudekum and Tom Mirenda. The specimens were collected for life history and trophic studies.

Dr. Sheila Conant, University of Hawaii, made an extensive collection of plants occurring at Laysan and Lisianski Islands and Pearl and Hermes Reef. She also provided the Refuge Manager with color photographs of each of the species collected in its natural habitat.

Dr. Wayne Gagne, Bishop Museum, collected about 1,850 terrestrial arthropods at Nihoa. His list added 37 species to the list of terrestrial arthropods previously recorded for this island.

A juvenile male monk seal was captured at Laysan Island and transported via the NOAA ship TOWNSEND CROMWELL to Honolulu without incident. The animal is being maintained at the Waikiki Aquarium, has undergone a normal molt, has gained considerable weight, and appears in excellent health. Physiological research will commence in early 1984.

With the development of the Hawaiian monk seal recovery plan, comes the necessity to develop and/or test marking techniques, equipment attachment mechanisms, tranquilizer drugs, disease treatments, captive maintenance techniques, and tooth aging reliability; and to determine the degree of correlation between food items ingested by seals and recovered from their scats. These are the basic questions that will be addressed through research on a few captive male monk seals.

Nine mature male Hawiian monk seals were captured by NMFS biologists at Laysan Island and translocated to Johnston Island in November, 1984. The animals had been implicated in "mobbing" attacks on females, which often resulted in injury or death. The "mobbing" behavior is attributed to a biased sex ratio (i.e. a preponderance of males).

15. Animal Control

A plan was drafted which documents the steps to be taken if rodents were to be accidentally introduced on any of the refuge islands (see D.2. above). No exotic wildlife species occur within the refuge at present.

16. Marking and Banding

A wedge-tailed shearwater banded at Tern Island in 1980 was recovered in Guatemala during September, 1982. Biologists have suspected that wedge-tailed shearwaters from the Hawaiian area winter in central and South America. This recovery supports that hypothesis.

Bird Banding

The following table summarizes bird banding activity on the refuge in 1983 and 1984:

Species	1983	1984	Location
Black-footed albatross	1		Pearl and Hermes Reef
	132		Tern Island
		38	Nihoa Island
Laysan albatross	587	596	Nihoa Island
		152	Necker Island
		1	Nihoa Island
Bonin petrel	72	4	"
Wedge-tailed shearwater	86	6	"
Red-tailed tropicbird	4	130	"
Masked booby	148		Laysan Island
	3		Tern Island

Bird Banding table cont.

Species	1983	1984	Location
Brown booby	17		Laysan Island
Red-footed booby	6		"
	225	551	Tern Island
Brown noddy	10		"
Black noddy	99		Laysan Island
	430	1,091	Tern Island
White tern	141	62	"
American coot	1		"
Bristle-thighed curlew	2		"
Ruddy turnstone	4		"
Cattle egret		1	"
TOTALS	1,968	2,632	

Tern Island Assistant Refuge Manager Good reading the band on a black noddy at Tern Island. RCW

Seal Marking

NMFS biologists tag numerous seals on the refuge each year. To enable determination of whether a few adult male seals are involved in injury and mortality of immature seals as a result of forced mating, adult males displaying this behavior are approved

for double flipper tagging. - Tagging pups annually will provide data on age specific survivorship as each year's cohort of pups is monitored. It will be possible to detect any differential mortality which may contribute to imbalanced sex ratios, and any geographic differences in survivorship will be evident. It will also be possible to determine if the already imbalanced sex ratios (i.e., the relatively high number of adult males) causes or contributes to higher mortality of young seals. The age at which male seals are recuited into the breeding population can be determined by monitoring each year's cohort, as can the age at first reproduction of female seals. Bleach marking is used to identify individual seals for monitoring behavior.

The following tables quantify the various marking schemes used in monk seal research in the HINWR:

Monk Seal Marking in NWHI
1983-1984

TAGGING

LOCATION	ADULT MALES		PUPS	
	1983	1984	1983	1984
Pearl and Hermes	0	0	10	13
Lisianski	0	0	24	15
Laysan	3	1	20	29
FFS	0	0	0	92
Necker	0	0	1	0
TOTAL	3	1	55	149

	1983	1984
Total seals tagged:	58	150

BLEACH MARKING

LOCATION	NON-PUPS		PUPS	
	1983	1984	1983	1984
Pearl and Hermes	22	0	0	0
Lisianski	101	0	0	0
Laysan	221	273	0	0
FFS	0	0	86	0
Necker	42	0	0	0
TOTAL	386	273	86	0

	1983	1984
Total seals bleach marked:	472	273

Turtle Tagging

As part of the green sea turtle monitoring program on French Frigate Shoals, NMFS continues to tag animals on an opportunistic basis. Inconel tags were placed on the hind edge of the front flipper. The following table displays the number of turtles (not including hatchlings) tagged on refuge islands in 1983 and 1984:

LOCATION	1983	1984
Pearl and Hermes Reef	239	165
Lisianski Island	18	7
Laysan Island	3	3
French Frigate Shoals	28	158
Necker Island	3	0
TOTAL	291	333

From July 26-August 8, 1984, NMFS researchers Gail Peiterson, Robin Westlake, and Susan White collected a total of 2,542 green turtle hatchlings from East, Whale-Skate, and Trig Islands. All of these were single foreflipper tagged with titanium tags. Tagged hatchlings were released at East, Whale-Skate, and Tern Islands.

Approximatly 450 hatchlings were dug out of previously erupted nests. All but 200 of these were released untagged because they appeared to be very weak animals that would probably not survive. The other 200 were retained for captive tag retention and autograft studies. Autografts and double flipper tags were applied on Tern Island before departure to Honolulu. Approximatley 30 hatchlings died the night before departure, more died in the morning prior to flight time. By the time the plane reached Honolulu and the turtles were delivered to the Waikiki Aquarium most had died and all but 12 died in the next few days. We suspect these were initially weak individuals having never emerged from their nests and that the handling, shipping, and temperature stresses were more than they could handle.

Before attempting to perform this tagging study again, NMFS has decided to wait and see what the Pacific sea turtle recovery team may recommend in this regard. Many of the titanium tags misfired or broke when applied, so further work needs to be done on the hatchling tag itself.

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).

Noteworthy visitors to Tern Island included: Andre Harvey who created a bronze sculpture of the Hawaiian monk seal and green sea turtle released in 1984 as part of the celebration of the 75th anniversary of the Hawaiian Islands NWR; Noel Grove of the National Geographic Society who visited the Refuge to obtain material for a book that he is writing on the National Wildlife Refuge system; John Twiss, Doug Chapman, Lee Eberhardt, Doug MacCullum, Jim Nofsieger and Bob Weedum of the Marine Mammal Commission; Dr. Murray Daily, a crustacean biologist who works

for a shrimp fishing company operating vessels in the NWHI; and Rick Gore, of the National Geographic Society, who was writing an article on the Hawaiian archipelago.

Crews from a number of fishing and other vessels were invited to visit Tern Island in an effort to foster cooperative relationships. The vessels included the IWA, FERESA, ELLIE B, TOWNSEND CROMWELL, and KILA.

The Tern Island facilities were transferred from the U.S. Coast Guard to the FWS in 1979. The generator and shop building is on the immediate left, water storage tanks are at center, and the barracks building is in the background. RJS

7. Other Interpretive Programs

A 16 mm film was produced on the Tripartite studies conducted in the NWHI. The film depicted the abundant fish and wildlife resources in the area and documented the research and planning efforts of the four cooperating agencies. It was edited by Cine-Pac Hawaii.

Refuge Manager Ludwig presented a lecture/workshop on the subject of management of remote island refuges and Master Planning to a Marine Options Program class at the University of Hawaii.

Complex Manager Shallenberger participated as a panelist in a filmed discussion meeting relating to the NWHI as part of the

National Higher Education Week program at the University of Hawaii.

9. Fishing

Fishing, hunting and other forms of recreation are not allowed within the Refuge.

I. EQUIPMENT AND FACILITIES

1. New Construction

1983: All construction activity within the refuge occurred at Tern Island. A new boat dock was constructed and a ladder installed at the small boat landing. Concrete was poured around the sea wall in this area to prevent personnel from tripping while carrying supplies to the boats. A new addition to the boat house to make room for another 17 ft. Whaler was completed. A fresh water line was plumbed to the shop. A new diesel fuel delivery system was installed. A mooring for large vessels was fabricated and deployed on the west side of the turning basin. A gasoline storage shed was erected midway along the runway on the south side.

Tern Island Refuge Managers Andre and Fairaizl constructing the boat dock at Tern Island.

1984: The garage at Tern Island was enlarged to accommodate the backhoe tractor. A desalinator was installed to alleviate occasional water shortages experienced during periods of drought.

2. Rehabilitation

Rehabilitation and repair is a constant activity on Tern Island because of the corrosive effects of salt spray in a tropical environment.

1983: Corroded metal parts on three boat trailers, the pickup and the tractor were sand blasted and repainted. New rub-rails (escalator railing) were installed on two of the Whalers. Rust on the diesel fuel storage tanks was scraped and the tanks were painted. Kitchen appliances, the air compressor and an air conditioner were repaired. The interior of the main barracks building, including three guest bathrooms and the kitchen, was repainted. The refrigerators were overhauled and tuned up. Numerous switches and valves in the salt water system were replaced. Corroded window latches in the barracks were replaced. The wind sock frame was replaced. Storm damage to building roofs was repaired. RV EASY RIDER rehabilitated the refuge sign on Laysan Island during a trip in April.

1984: The exterior metal panels of the barracks were repainted and storm damage to the boat dock was repaired.

3. Major Maintenance

Maintenance activities at Tern Island included regular servicing of the electrical generators, tuneups of outboard motors, a truck, a back-hoe, an ATV and a variety of pumps and motors that are integral parts of the refrigeration, water supply, sewage and other systems on the island. Wind and waves at Tern Island frequently erode the runway and portions of the island adjacent to the bulkhead. The runway was scraped periodically and the holes behind the bulkhead were constantly refilled.

1983: A new brake system was installed in the pickup. A general cleanup effort at Tern Island included painting the refuge sign, stair hand-rails, gas barrel racks, chain and posts in front of the barracks, oil and gas strorage sheds, restricted area signs and the picnic table. "Junk" strewn around the island during the Coast Guard occupation was picked up and placed in the dump. Trash was picked up from the beaches and around the buildings. Grass was mowed. The old fuel delivery pipe was removed from the fuel storage tank area. The barracks was cleaned as was the work shop area and the gas storage area. Old LORAN and Caterpillar generator parts left by the Coast Guard were discarded.

1984: Especially troublesome problems included a replacement of a faulty coil in the stator of the generator and overhaul of two refigerator compressors.

4. Equipment Utilization and Replacement

1983: Rust damage to the pickup resulted in a collapsed A-frame, leaking brake and fuel systems, and a shorted electrical system. Replacement of the pickup with an ATV was recommended. Replacement of two outboards, both several years old was also recommended.

1984: The Dodge pickup was finally retired due to extensive rust damage and replaced with an ATV (Heald Hauler). The ATV can haul 300-500 lbs. of cargo in its bed as well as the boat and trailer around Tern Island. A new chlorinator was installed in the water treatment system. All circuit breakers in the pumphouse were replaced after a major short developed.

5. Communications Systems

1983: A new programmable Micom S high frequency radio, antenna, and coupler were installed at Tern Island. Problems were experienced with the radio initially which were traced to voltage surges. A surge protector solved the problem. A new antenna and coupler were also installed on the back-up radio system to improve radio transmission during the winter storm season and hot afternoons.

1984: The control cables between the Non-Directional Beacon (NDB) transmitter and coupler were buried and the transmitter was returned to Honolulu for repairs. The beacon, which is used by incoming aircraft, broke down due to voltage surges and corrosion.

7. Energy Conservation

1983: A contract was awarded to the Pacific Analysis Corporation to evaluate the potential of alternative energy sources for Tern Island. The study compared wind generators and photovoltaic systems to the present diesel system.

1984: The pickup was retired and boat use cut back to conserve gasoline, which was difficult to get to Tern Island. One reefer and all air conditioners were shut down to conserve diesel fuel which was also in short supply during the year. The generator was also shut down two hours earlier each night.

Coast Guard enforcement of a regulation, of which the FWS was previously unaware, precluded the charter of fishing vessels to carry bulk fuel. Late in the year, bids were solicited on a contract for a Coast Guard certified vessel to transport 10,000

gallons of diesel to Tern Island. The low bid was over $30,000 and deemed unacceptable.

The Pacific Analysis Corporation submitted their report on alternative energy sources for Tern island. Wind generators, photovoltaic and battery storage systems were not found to be cost effective, so the two 17.5 kw diesel-powered generators functioning singly on alternate days will continue to be used.

8. Other

Considerable time was spent in the coordination of flights and boat trips to supply Tern Island with food, fuel, mail, support equipment and supplies. The fishing vessels FERESA, ELLIE B, EASY RIDER, NIGHTINGALE, DRAKKAR, 4-SEAS, and DAY STAR provided free transport of materials and supplies during the two years. In addition, the research vessels TOWNSEND CROMWELL (NOAA) and the KILA (State of Hawaii) provided free transport of personnel and supplies. Logistical support by plane for Tern Island included one or more flights per month for a total of 29 flights during 1983 and 1984. Usually, flights are scheduled every 36 days for the delivery of fresh food, supplies, personnel, and mail to the island. Twenty additional flights were funded by other organizations (National Marine Fisheries Service, National Weather Service, Hawaii Undersea Research Laboratory, etc.) to transport their personnel and supplies.

J. OTHER ITEMS

1. Cooperative Programs

The Tripartite Cooperative Agreement between the FWS, the National Marine Fisheries Service and the State of Hawaii concluded in 1983 as discussed above (see D.5.). Research conducted under this agreement resulted in a wealth of valuable information on the resources of the HINWR including much that is useful for resource management.

3. Items of Interest

1983:

1. A contract (one year, renewable for two additional years) effective February 14 was awarded to Mr. Robert Justman, Hawaiian Sky Tours for supply and personnel flights to Tern Island and photographic flights over the entire Refuge. Mr. Justman's successful bid was $2,700 for the round trip flight to Tern Island.

2. Mrs. Gale Fairaizl, refuge volunteer and wife of Assistant Refuge Manager Fairaizl, was evacuated from Tern Island on September 11 by a Coast Guard C-130 aircraft. She was complaining of stomach pain, diagnosed by a VA doctor over the radio as a probable appendicitis. Her appendix was removed in Honolulu. This was the first time a C-130 landed at Tern Island since the Coast Guard shut down their LORAN station in July 1979.

3. Because of the difficulty encountered by previous Tern Island staff in securing suitable positions at the conclusion of their employment period on Tern Island, the Regional Office agreed to guarantee Tern Island staff that the Region will find and offer the employee at least one position for which he qualifies, of equal or advanced grade and in the same or related job series. Before seeking Regional Office help in placement, the employee must (1) have completed 18 months of service on Tern Island at an acceptable level of performance, (2) agree to remain on the island for at least two years, and (3) aggressively seek a new position on his own through the green sheet process.

1984:

1. Tern Island staff provided radio assistance to the fishing vessel FORTUNA following the breakdown of its main engine 50 miles southeast of French Frigate Shoals. Staff aided in arrangements to tow the vessel to Honolulu.

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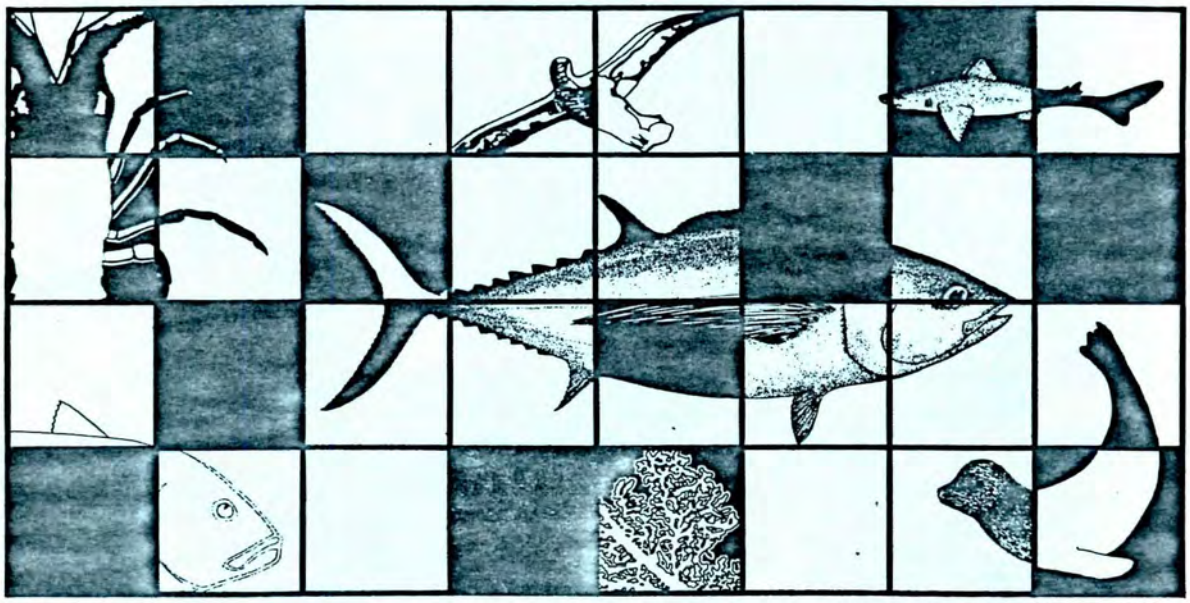

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MANAGEMENT OF THE HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

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ABSTRACT

Management of natural resources on federal lands demands accountability to the public. Yet, public "opinion" is not easily defined nor are differing opinions easily reconciled. Management decisions are further complicated when predictive capability is limited by the absence of relevant scientific data. Tripartite-Sea Grant studies in the Northwestern Hawaiian Islands (NWHI) provided data indicating the potential harvestability of various fishery resources, the anticipated direct and indirect effects of fishery development on fish and wildlife, the unique values of NWHI ecosystems, and the interrelationships of terrestrial and marine species and their habitats. These studies also demonstrated the need to apply an ecosystem approach to resource management acknowledging that fish and wildlife and the human activities that affect them have little regard for institutional boundaries. With this in mind, the U.S. Fish and Wildlife Service's (FWS) future role in the NWHI will address management needs both within and outside refuge boundaries, through the continuing cooperation of other agencies. Outside refuge boundaries, FWS will continue it's efforts to influence activities that jeopardize fish and wildlife and their habitats. Cooperative work on migratory birds and endangered species on Midway Islands and Kure Atoll will continue. Within refuge boundaries, wildlife populations will be closely monitored to document natural fluctuations and to assess the effects of fishery development. Methods to detect the presence and prevent the establishment of exotic pest species will be developed and tested. Access to refuge lands and waters will be controlled to minimize unnecessary disturbance to wildlife. Cooperative research programs will focus on species in jeopardy.

FWS's educational program will expand. The scheduling, ranking, and development of details for these and other programs will be a major focus of FWS's refuge master planning project, scheduled to begin immediately. Master planning for the Hawaiian Islands National Wildlife Refuge will ensure application of national policy, provide a basis for future budgeting, establish long-range management strategies, and provide continuity in refuge management. Public input will be assured throughout the planning process.

ecosystem
master planning
endangered species
National Wildlife Refuge
resource management
Northwestern Hawaiian Islands

INTRODUCTION

I have a distinct advantage over other speakers in that I have had the opportunity to hear all the presentations before my turn to participate in the tripartite-Sea Grant symposium. We've all heard some fascinating information about this unique part of the world we call the Northwestern Hawaiian Islands. We've heard about the terrestrial ecosystems that support unique assemblages of land birds, insects, and plants; diverse and abundant seabird populations; and monk seals and turtles that congregate to breed on small spits of land, but range widely in search of food. In the marine environment area, we've heard about the evolution of coral reefs and the Darwin Point, variation in reef fish and coral diversity and abundance along the archipelago, and the trophic relationships within the atoll ecosystem. Overall, we've learned through our combined efforts that the NWHI present unique potential for even greater understanding, a baseline or barometer against which to assess similar ecosystems around the world. Finally, we've also learned that only through continued study can we develop the tools to correct or reverse the disturbing trends in population and habitat condition that reflect former abuses.

In reflecting on what we have learned, I find it interesting to speculate on how we might interpret this information differently had the impetus for the tripartite-Sea Grant study been different. The driving force for the study was the desire to exploit: to determine if there was an economically harvestable fishery resource and, secondarily, to evaluate the possible effects of that harvest on other resources. What if the driving force had been the desire to seek a greater level of protection and recognition for the unique fish and wildlife resources of the NWHI, and only secondarily to determine how this protection might affect the development of commercial fisheries? Although this sounds like a semantics exercise, it's actually easy to see how this might have come about, perhaps during consideration of research natural area, wilderness area, or critical habitat designation. The important point to recognize is that the interpretation of scientific data cannot be entirely independent of

the perspective from which it is viewed. Both of the perspectives I have described are legitimate in their own right and should be fully considered in resource management planning.

Management of natural resources is an awesome responsibility. I find myself accountable to the public, to the resource, and to my own conscience. I am lucky enough to work for an agency with whom I share resource management philosophies, so my conscience can be satisfied relatively easily. It's also easy to convince myself that I am doing right by the resource, based upon the application of proven management methods. Only my accountability to the public is difficult to reconcile. Just who is this "public" that I'm accountable to? The "public," in fact, manifests itself in the form of a diverse body of opinion on how I should be doing my job. This opinion is not static in time nor is it always predictable. What is predictable is the fact that most often opinion is expressed as criticism, perhaps because those who are satisfied with the way things are going have other more pressing issues to worry about. My life on the job became easier when I accepted the fact that I could not satisfy all the varied desires and objectives of the public and still make amends to my conscience and the wildlife resource I am obligated to manage. It also helped to realize that public "opinion" is also manifested in the laws and regulations passed by elected officials, in spite of the fact that these mandates often seem to be in conflict with the most vocal constituency.

In making resource management decisions, it is also a given fact that one is inevitably forced to deal with less information than might be wanted or perceived to be needed. Stated another way, the outcome of future events is always predicted with uncertainty, sometimes far more than others. The purpose of the tripartite-Sea Grant study was to reduce uncertainty but it was clearly not feasible to eliminate that uncertainty altogether. In spite of the vast amount of data collected in this study, there still remains enough uncertainty to fuel a debate regarding the abundance and harvestability of certain fisheries, the anticipated impacts of expanded fishery development on various wildlife resources, and the effect of potential management actions, such as critical habitat designation, on fishery development.

SUMMARY OF STUDY RESULTS PERTAINING TO REFUGE MANAGEMENT

With that introduction behind us, let's review the study results without consideration of the original study objectives and see what we have learned. If I generalize I can summarize the results that are most relevant to refuge management in eight separate statements:

1. Certain fisheries outside refuge boundaries appear to have substantial potential for expanded commercial development, while others appear to hold less promise than anticipated.

2. The condition of refuge fish and wildlife and their habitats still reflects the direct and indirect effects of historical commercial resource utilization and other human activities in the NWHI.

3. Several of the proposed fisheries in the NWHI are unlikely to directly affect refuge wildlife. Yet, some conflict resulting from fishery development through the food web and through indirect habitat alteration is inevitable. The degree of conflict will likely vary when different wildlife species and their habitats are compared. In the case of seabirds, effects are anticipated to be localized and focused on a few species, depending upon which fisheries are developed. Effects on turtles and seals will likely be indirect, given appropriate fishery management measures, but certain subpopulations are particularly vulnerable through subtle effects of disturbance and habitat alteration. Terrestrial ecosystems are highly vulnerable to rapid and irreversible alteration, but risks associated with fishery development appear to be manageable, given sufficient user cooperation.

4. Terrestrial and marine ecosystems of the NWHI present unique opportunities for study, both as undisturbed areas and as sites whose history of human intrusion is well documented.

5. Terrestrial and marine ecosystems of the NWHI are inextricably linked without regard for refuge boundaries or other institutional considerations. Thus, security and well-being of refuge fish and wildlife cannot be ensured if waters and resources outside the refuge boundary are not properly managed.

6. Refuge fish and wildlife populations and their habitats are subject to natural fluctuations independent of fishery-related activities, both for reasons that have been documented and for reasons unknown. Some populations are increasing while others have experienced substantial declines.

7. Fishery-related impacts and problems unrelated to fishery development that affect refuge wildlife are additive, and potentially synergistic, in their effects.

8. Anticipated fishery-related impacts and the unrelated refuge resource problems can, to varying degrees, be monitored and mitigated.

REFUGE MANAGEMENT CONSIDERATIONS

Reflecting on this oversimplified summary of results, one can begin to see the complexity of the resource management issues surrounding the Hawaiian Islands National Wildlife Refuge (HINWR). This is not your everyday refuge. In fact, there are very few like it in the National Wildlife Refuge System (NWFS), and virtually all of those few that are at all similar are found in the Hawaiian and Pacific islands NWR complex. This refuge supports more threatened or endangered species (6) than most others and it is the only one in which the entire range of one or more listed species is confined to the refuge. The HINWR also has the dubious distinction of being the only refuge in the NWRS in which the extinction of wildlife species has been documented, and this refuge lost three. Together with the Aleutian Islands NWR, this refuge also supports a larger and more diverse nesting seabird population than all others in the NWRS.

So what has all of this got to do with the management of refuge fish and wildlife resources? Quite a lot, actually. The unique characteristics or attributes of the HINWR, as reflected in the results of the tripartite-Sea Grant studies, must be fully considered. I'll address a few of these characteristics and how they affect the evolution of site-specific management plans. Both biological characteristics and other more practical considerations are involved.

Endangered Species

The fact that six listed species inhabit refuge lands and/or waters is a significant factor in resource management. Among the interrelated characteristics of most listed species that inhibit recovery are the restricted or fragmented distribution, the unbalanced sex and age composition of subpopulations, and specialization in habitat requirements. These factors contribute to vulnerability and may prevent rapid recovery even in the absence of adverse human influence. Management actions to reverse population trends are complicated by limitations in relevant data. Often the very regulations enforced to protect the species make research to gather management data more difficult to accomplish than is the case for unprotected species. In the HINWR, logistical considerations inhibit our ability to detect and to react to problems in a timely way and add considerably to the cost of research and management programs. In the case of species which spend a large portion of their life at sea, such as the monk seal and green turtle, practical limitations on research itself inhibit development of management strategies. Of course, low populations to begin with provide less room for error and more urgency in action than other species. Finally, the legal mandates which are designed to protect these species provide relatively little flexibility in the consideration of otherwise legitimate resource utilization programs.

Migratory Birds

Although legislative mandates protecting migratory birds are less restrictive than those affecting endangered species, they are nevertheless a real factor in HINWR management programs. These mandates stem from international treaties; hence, involvement in management planning goes well beyond state or even national boundaries. It is important to note that the HINWR provides only a part, albeit a significant one, of the habitat required by NWHI seabirds. Most prey is taken outside refuge boundaries and, for some species, outside waters under U.S. jurisdiction. Historical evidence in the NWHI and elsewhere makes it clear that the apparent abundance of seabirds in their breeding colonies can be misleading. Seemingly insignificant alterations of habitat can and have led to population declines from which full recovery may require decades or may not be possible at all. Finally, we have also learned that seabird populations are subject to substantial natural fluctuations in productivity. These fluctuations are not easily detected in their earliest stages and the natural causes are not easily elucidated.

Small Insular Ecosystems

The vulnerability of terrestrial habitats in the HINWR to rapid alteration is intimately tied to their small size, isolation, and other biological characteristics. The seemingly insignificant introduction of an exotic insect, plant, or rodent can radically alter the terrestrial ecology of these islands, irreversibly in some situations. The value of these unique ecosystems as habitat of endangered land birds is at risk when any authorized or unauthorized human intrusion occurs.

Atoll Ecosystems

Atoll ecosystems are widely distributed in the Pacific so this cannot be considered an aspect of resource management unique to the NWHI. Yet, atoll ecosystems in the NWRS are virtually restricted to Pacific refuges, and the HINWR is the most endowed in this regard. Furthermore, tripartite-Sea Grant data confirmed the unique opportunity that NWHI atolls of variable age along a latitudinal gradient present for research. NWHI atolls are also distinct in comparison with most other Pacific atolls where the effects of centuries of resource exploitation are evident. Resource management within atolls, such as those in the HINWR, is a discipline lacking in the benefits of past experience that characterizes the terrestrial and wetland habitats found in most national wildlife refuges.

Protected Areas

Mechanisms for recognizing and protecting the unique attributes of areas which are relatively free from past human abuse and are extremely valuable for wildlife are found in specific

forms of authorizing legislation. National Wildlife Refuge designation, in itself, is one such form of area recognition that brings with it a host of implementing regulations designed to avoid adverse impacts on fish and wildlife resources and their habitat. The research natural area designation is an additional form of recognition that acknowledges the unique "natural" value of specific areas where research on essentially undisturbed ecosystems should be encouraged. Such contiguous research natural area designation for lands and waters of the HINWR in 1967 provides additional direction in resource management that is uncommon in the NWRS. Wilderness area status, pursuant to the Wilderness Act of 1964, specifically addresses the congressional mandate to identify those federal lands that should be maintained in perpetuity in their natural state. The HINWR was proposed for wilderness area status a decade ago. No action was taken on the proposal, not because it lacked merit, but as a result of opposing interests fearing that the action would prevent commercial fishery development. Similar concern was voiced in response to a 1978 proposal by the National Marine Fisheries Service (NMFS) to designate the area a critical habitat for the monk seal, pursuant to the Endangered Species Act. The issue of wilderness area or critical habitat designation is virtually certain to resurface in the future. Other forms of area designation, including potentially international recognition, are likely to be considered in the future as well. All of this adds up to a situation in which the management strategies for the HINWR must take into account the significance of existing or potential layers of formal recognition.

Shared Jurisdiction

Shared jurisdiction for fish and wildlife resources and their habitats in the NWHI is an issue directly affecting the Fish and Wildlife Service's resource management strategy, both within and outside the HINWR. Lands and waters of the HINWR, as defined by FWS, are also included within a State Wildlife Refuge. State statutes also protect migratory birds, endangered species, and other fish and wildlife in the HINWR, and state fishery regulations affect the taking of fishery resources in state waters immediately adjacent to the HINWR. NMFS and FWS share jurisdiction over marine turtles, depending upon whether they are on land (FWS) or in the water (NMFS). By interagency agreement, pursuant to the Marine Mammal Protection Act, NMFS was assigned primary jurisdiction for the monk seal. Yet, refuge regulations (50 CFR) provide FWS with shared enforcement and management authority for both seals and turtles within the HINWR. The FWS enforcement role, pursuant to the Migratory Bird Treaty Act, extends throughout U.S. lands and waters, and project review authority, pursuant to the Fish and Wildlife Coordination Act, affects all proposed projects in navigable waters. In the past, all of the shared jurisdictional responsibilities in the NWHI have led to some confusion and complication in the planning and implementation of management strategies. Conversely, they have also provided opportunities for additional expertise, manpower, program

funding, enforcement capability, and logistical support. Broader legislative authorities, even when duplicative to some degree, also provide additional safeguards in the management of species in jeopardy.

Geographic Area

One final practical consideration affecting the HINWR management program is worthy of note. In the NWRS, only the Aleutian Island NWR is more widely distributed geographically than the HINWR. More than 1,000 miles separate the western extreme of the HINWR at Pearl and Hermes Atoll from Nihoa, the eastern end of the refuge. Hundreds of miles of open ocean isolate the rocky islands and atolls of the refuge from each other. While this presents unique opportunities for study, it also creates unique logistical problems that are difficult to overcome. Enforcement of refuge regulations, early detection and control of introduced pests or environmental contaminants, and wildlife population monitoring are all made more difficult simply by the distances and logistical support costs involved.

THE HINWR IN PERSPECTIVE

All of this is a preface to the real purpose of this paper -- to review management strategies for the HINWR and adjacent waters. It is important to clearly distinguish the refuge itself from surrounding waters. To put it in perspective, one should consider that the lagoon waters within the refuge (as defined by FWS) amount in area to less than 1/10 of 1 percent of the waters included within the fishery conservation zone. They also include less than 10 percent of the water within the 100-fathom contour. Yet, in spite of the small fraction of area involved, the refuge is clearly the focal point of management controversy because of the potential role of refuge land for logistic support, the possibility of lagoon fisheries, and the potential direct and indirect impacts of fishery activities in adjacent waters.

It is my opinion that FWS has a legitimate interest in the management of habitat and fishery resources both within the outside refuge boundaries. But the expression of that interest and management concern will take different forms. In the past, interest in the management of waters outside the HINWR has manifested itself in participation in the development of fishery management plans for the fishery conservation zone, in the support of shipping regulations to minimize the risks of hazardous cargo or oil spills and in the cooperative management of seabird and other wildlife resources on Midway and Kure atolls.

MANAGEMENT STRATEGIES OUTSIDE REFUGE BOUNDARIES

In the future, FWS participation in management planning outside the HINWR is anticipated to take several forms. Where data warrant restrictive fishery regulations to mitigate impacts to fish and wildlife species, such measures will be advocated by

FWS. Among the measures which will be considered are regulatory provisions with fishery management plans that would enable enforcement of short-term restrictions on specific commercial fisheries when the combined effects of natural factors and fishery-related factors would severely impact wildlife inhabiting the refuge. The very real growing risk of vessel groundings associated with fishery development and increasing shipping activity, in my opinion, justifies serious consideration of measures to monitor and, where appropriate, limit this vessel activity. Vessel monitoring could be accomplished through observers and reporting programs, but a system of satellite monitoring may prove more economical and effective. Such a system would also reduce safety hazards associated with groundings that would not otherwise be immediately detected. The sinking incident of the Keola at French Frigate Shoals in 1981 is an example where satellite monitoring of vessel position could have led to timely rescue of the crew. Rapid detection of groundings would also permit timely response to mitigate effects of oil spills and to avert the successful introduction of rodents to NWHI. Similarly, a program of boat inspections and required rodent control actions for vessels fishing in the NWHI may help to prevent exotic mammal introduction. FWS will also continue to work with the state of Hawaii, the Coast Guard, the Environmental Protection Agency, and the shipping industry to minimize risks of groundings and oil spills. Where current licensing regulations do not adequately insure competency of operators in hazardous waters, then modification of those regulations quite likely will be an FWS objective.

FWS will continue to play an educational role where such effort can help to avoid potential conflicts with shippers and fishermen. Effort is currently being made to meet with boat owners and captains unfamiliar with NWHI waters both to inform them of refuge boundaries and regulations and to make them aware of the FWS field station at Tern Island in case our support is needed.

In cooperation with other agencies, FWS will also continue to investigate the hazards posed by fishing and shipping activities well beyond the limits of U.S. jurisdiction. One such hazard, the discarding of trawl nets from North Pacific fisheries, is believed responsible for entanglement of seals and turtles in the refuge. Resolution of this problem may require State Department intervention.

FWS will also continue to share interest in the management of lagoon waters and islands at Kure and Midway with the agencies having primary jurisdiction. At Midway, FWS currently assists in wildlife management under a memorandum of agreement with the Navy. Ongoing programs to reduce predation on seabirds, to control avian disease, and to minimize bird-aircraft strike hazards are anticipated to continue. FWS is also reviewing other shared management alternatives at Midway that would protect and enhance wildlife populations, including endangered monk seals.

Midway will also continue to be an important site for seabird population monitoring due to the opportunities for year-round study. The FWS role at Kure Atoll will continue to be minor, compared with their role at Midway. However, it is anticipated that assistance in wildlife population monitoring using methodology developed in tripartite-Sea Grant research will occur.

MANAGEMENT WITHIN THE HINWR

Unquestionably, the management role of FWS within the HINWR will substantially differ from its role outside its area of primary jurisdiction. Despite the very real involvement of other agencies, FWS is ultimately the accountable agency when the success or failure of management programs is reviewed. The buck stops here. In my perspective, the HINWR is a trust fund and in my role as refuge manager, I act as a trustee. I look upon the refuge as an investment in the future which can prosper if properly managed or can falter is poorly managed.

Historically, management of the HINWR has been directed towards the maintenance of a "healthy ecosystem." Manipulation of habitat has been limited to that considered necessary to restore conditions which have changed through the direct or indirect effects of human use of the area. This approach is in direct contrast to the manipulative, intensive management of habitat that characterizes most wetland refuges in the system. Under the "healthy ecosystem" approach, directed work with wildlife has been focused on research to document and monitor population status and habitat condition.

Public use policy in the HINWR has been substantially more restrictive than in most other refuges in the NWRS, recognizing both the uniqueness and vulnerability of the area. As is the case on all national wildlife refuges, public use has been and will continue to be secondary to the primary objective of the refuge. Public use consistent with the wildlife management objectives has been permitted and even encouraged. The refuge was designated research natural area in 1967 in recognition of its unique value for legitimate scientific research. Extensive use of the Tern Island field station for tripartite-Sea Grant research has been another appropriate, but well controlled, use. Other public uses, including commercial fishery support, have been carefully scrutinized and, where appropriate, have been accommodated.

With the conclusion of tripartite-Sea Grant studies, we now embark on a new phase of resource management, hopefully with no less cooperation and mutual assistance than characterized the study period. Management actions on refuge lands and waters will reflect the results of the research and the plans of other agencies, including the prospect of expanded commercial fisheries in adjacent waters. Some historic management practices will surely continue, but our minds are open to consider virtually all

options that recognize primary refuge goals. Among the management actions underway or under consideration are the following:

1. Development and implementation of seabird and landbird populations and productivity monitoring programs

2. Development and testing of methods to detect and control, if necessary, introduced rodents, insects, and pest plants on refuge islands

3. Assessment and control, where appropriate, of disease among HINWR seabird and landbird species

4. Enforcement of restrictions on access to refuge lands and waters supporting particularly vulnerable or sensitive wildlife populations

5. Consideration of additional forms of recognition or resource protection, where appropriate, for individual species or geographical areas of the refuge

6. Development of protocol for avoidance, detection, and response to oil spills and other major pollutant sources

7. Completion and implementation of recovery plans for threatened and endangered species in the HINWR. Research on these species will focus on factors inhibiting recovery. Management actions to arrest and reverse downward population trends will be implemented.

8. Planning and implementation of both on-site and off-site environmental education programs

9. Documentation and study of cultural resources in the HINWR and implementation of necessary measures to ensure their protection

10. Involvement of FWS in the operation of the Tern Island facility, including the continued assistance to commercial fishermen. Review of alternative management strategies will also continue.

FUTURE PLANNING DIRECTIONS

Appropriately, the logical vehicle for making reasoned management decisions is the formal planning process. The involvement of the affected public and other agencies can only be assured through adherence to a well-conceived and structured planning process. As was anticipated, progress on various planning initiatives relating to the NWHI did not cease during the tripartite-Sea Grant study. The period was characterized by a flurry of planning activity, including the Tern Island study;

the state of Hawaii's fishery development plan; the monk seal critical habitat proposal; recovery plans for endangered land birds and the monk seal; fishery management plans for lobster, precious coral, bottomfish, and billfish; and planning studies for fishery support facilities at Tern Island and Midway. During this period, FWS also completed its regional resource plan, which included a focus on migratory birds, endangered species, and fishery resources in the Pacific area. The plan provides a general framework of objectives and strategies stepped down from the FWS mission statement, the FWS management plan, and the program management documents for individual FWS programs.

Given the backlog of previous paperwork in recent years, why then does it make good sense to initiate, as yet, another planning process? From the FWS perspective, additional planning for the refuge will provide a needed site-specific focus and will provide additional opportunity for public involvement. The vehicle for planning at the refuge level is the refuge master plan. Through this process, specific objectives of the refuge are clearly established and the type of management and development necessary to meet those objectives are identified. The process will help to:

1. Ensure that national policy direction is incorporated into management of individual refuges

2. Determine the capability of individual refuges to further FWS goals, objectives, and long-range plans

3. Provide a basis for developing budgets to implement appropriate management programs

4. Provide a systematic process for making and documenting refuge decisions

5. Establish broad management strategies to guide refuge management programs and activities

6. Provide continuity in the management of individual refuges and the refuge system as a whole

To achieve these objectives, FWS has developed a comprehensive planning process which includes three phases of inventory, analysis, and evaluation of alternatives or synthesis. During the inventory phase, priorities are set, data are collected and resource information is mapped, where appropriate. Results of tripartite-Sea Grant studies are fundamental to completion of this phase for the HINWR. In the analysis phase, the capability of the refuge to accommodate existing and potential uses is determined. In the synthesis phase, objectives are set, alternatives to achieve the objectives are developed and evaluated, and a final plan is completed. The steps of the planning process, shown in Figure 1, each involve specific tasks

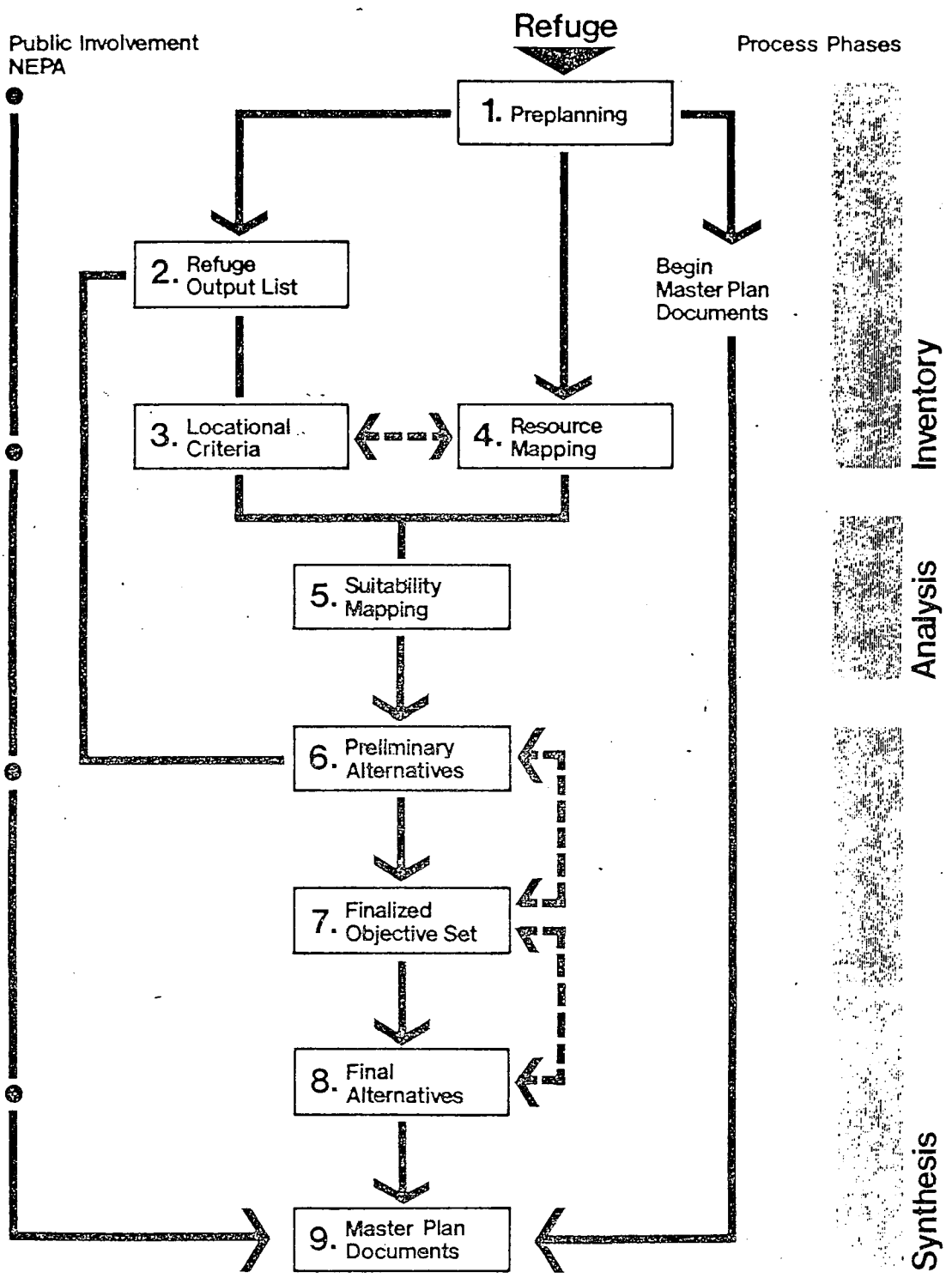

Figure 1. Master Planning Process

and products. Paralleling this process is the development and circulation of a draft and final environmental impact statement.

Products of the master planning process include (1) a resource inventory, (2) an output list (those things to be produced on the refuge) in priority order with numerical objectives where appropriate, (3) an objective documentation record, and (4) a long-range management strategy. This strategy is a description, in general terms, of refuge resources and management actions required to produce outputs in the quantities identified in the planning process.

In recognition of the concerns surrounding the management of the HINWR and the eagerness of the interested public and cooperating agencies to resolve lingering management issues, FWS has opted to schedule the HINWR for master planning during the 16-month period immediately following the NWHI symposium (Figure 2). This rapid schedule is feasible because of the related scoping effort initiated with the Tern Island study in 1979 and because the results of the tripartite-Sea Grant research provide a resource data base not usually available at the start of refuge master planning projects. Also, in contrast to many intensively manipulated wetland refuges, the range of potential active management options in the HINWR will be necessarily limited, reducing somewhat the complexity of the planning process.

Opportunity for public involvement will be provided in the planning schedule during scoping, in the development and review of outputs and preliminary alternatives, and in the review of the draft and final environmental impact statement. I strongly urge you to participate in this planning process, but at the same time I caution you to take your role seriously. With the privilege of public participation also goes a share in the responsibility for the results of the decisions made.

Victor Scheffer once defined wildlife management as "a process by which the closely related needs of wild animals and people are evaluated, reconciled and met." I see this as a desirable target towards which to shoot. Our tripartite-Sea Grant data provide a starting point for defining resource needs. Public involvement in planning will carry the process of defining human needs a step further. Together, these processes will not defuse or eliminate resource management controversy in the NWHI, but they will help to clarify and identify precisely which issues are in dispute and which are not. They will increase the likelihood that management decisions will be based upon the best available data and the informed consent of the interested public.

JOHNSTON ATOLL NWR

BI-ANNUAL NARRATIVE REPORT

Calendar Years 1983 and 1984

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. It is a coral atoll of approximately 32,700 acres with four small emergent islands totaling 691 acres. Two of the islands, North Island and East Island, were created from dredge spoil in the early 1960's. The other two, Johnston Island and Sand Island, were much enlarged from their original size during the same period. Johnston and Sand Islands are presently inhabited by about 300 military and civilian contractor personnel. No refuge personnel were stationed on the island during the period of this report. Operational control of Johnston Atoll is under the Defense Nuclear Agency. Johnston Island is utilized by the U.S. Army as a storage facility for chemical munitions and the atoll is maintained as a standby test site should the U.S. ever decide to resume atmospheric testing of nuclear weapons.

The refuge was established in 1926 by Calvin Coolidge (Executive Order 4467) "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 ISLAND NATIONAL WILDLIFE REFUGE

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4. Credits.....See Complex

A. HIGHLIGHTS

Considerable research activity occurred in and near the refuge as a result of the Johnston Atoll Chemical Agent Disposal System (JACADS) planned by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) for the disposal of chemical munitions. Environmental research and construction was coordinated by the U.S. Army Corps of Engineers, Pacific Ocean Division (COE-POD).

1983 saw a mini-submarine survey to depths of 1,200 feet on the reef slopes surrounding the refuge. Assistant Refuge Manager Ludwig participated in some dives, during which data were gathered on marine resources in the area.

The JACADS Final Environmental Impact Statement was filed in November, 1983.

In 1984, Dr. Ralph Schreiber of the L.A. County Museum began seabird population monitoring studies coordinated with the refuge manager's office and the COE-POD.

Dr. James Parrish of the FWS Hawaiian Cooperative Fisheries Unit at the University of Hawaii began an extensive study of the refuge's lagoon marine resources and the recreational fishery.

Offshore oceanographic and ecological research by Dr. Phillip Lobel of Harvard University concentrated on the current patterns and biological surveys in areas proposed for disposal of the JACADS scrubber brines. This study and other data were presented in the JACADS Brine Disposal Environmental Impact Study, which was reviewed by the refuge office for potential impacts.
Nine male Hawaiian monk seals were translocated from Laysan Island to Johnston Atoll in 1984.

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 site adjacent to the airfield. Observations for 1983 are summarized below:

	Yearly Average	Departure From Longterm	Highs/Lows
Temperature	76 F	+.7 F	66 F (Nov) 88 F (Aug)
Rainfall	13.99"	-12.53"	.12" (Feb) 2.73" (Oct)

Clearly, 1983 was a significantly drier year than normal for Johnston Atoll as it was for the entire central Pacific. These drier conditions were a manifestation of the abnormal climate in the Pacific, resulting from the severe 1982-1983 El Nino Southern Oscillation (ENSO).

In late 1984, the National Weather Service discontinued weather observations at Johnston, leaving only Holmes and Narver contractor personnel to record minimal weather data. Complete weather data for 1984 are, therefore, not available for inclusion in this report.

D. PLANNING

2. Management Plan

Coordination of the Environmental Impact Statement for the Johnston Atoll Chemical Agent Disposal Systems (JACADS) indicated that the JACADS project construction and operation would lead indirectly to greater impacts on fish and wildlife resources within the Johnston Atoll National Wildlife Refuge. We indicated in our letters of comment and at scoping meetings and briefings that JACADS would double the on-island human population and will proportionately increase interaction and impacts to fish, corals, shellfish, turtles, and seabirds due to increased diving, collecting (corals, shells), fishing, and other recreational activities.

Rather than to unilaterally strengthen existing base regulations on fish and wildlife conservation at this time, we felt it more prudent to assemble baseline information on refuge biological resources. These would serve as the basis for predicting the effects of past recreational activities on the resources, as well as predicting future impacts after a doubling of the population. This in turn would form the basis for any changes in base fish and wildlife regulations as well as the implementation of other management measures to conserve refuge resources. In a letter dated July 8, 1983, we identified the type and scope of studies we felt were necessary to lead to changes in refuge resource management. At subsequent meetings between FWS, Army, and DNA, clarification and agreement was reached among all parties on the scope and direction of future fish and wildlife investigations. Generally, POD will be responsible, on behalf of USATHAMA and DNA for the technical management of the studies and FWS will scope out and implement the studies subject to Army review and approval. DNA will facilitate base support and assistance at JA on a reimbursable basis. The Army will reimburse DNA for airline tickets, per diem, equipment maintenance, and other expenses incurred for the fish and wildlife investigations at JA.

A Memorandum of Agreement between the U.S Army Corps of Engineers, Pacific Ocean Division, and the U.S. Fish and Wildlife Service regarding support for two contracts conducted with JACADS funds was signed in 1983. The agreement outlined the responsibilities of each agency to provide support for the Oceanographic Survey of JA and the Aquatic Resource Inventory of JA.

An Implementation Plan for Fish and Wildlife Investigations at Johnston was signed by the U.S. Army Corps of Engineers, Pacific Ocean Division (COE-POD), the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), the Field Command, Defense Nuclear Agency, Johnston Atoll (FCJ), and the U.S. Fish and Wildlife Service in 1984. The plan outlined specific areas and schedules for future study. It also listed a budget for the studies and noted that funds would be provided by USATHAMA.

4. Compliance with Environmental Mandates

Refuge personnel participated in an EIS scoping meeting and public hearing regarding the JACADS project at Johnston Atoll. Comments were also made on the JACADS EIS.

5. Research and Investigations

1983: USATHAMA agreed to fund a long term monitoring study of sea birds at the atoll by Dr. Ralph Schreiber, Ornithologist, L.A. County Museum. In August Dr. Schreiber completed an initial short study of the birds, collecting data on phenology, abundance, and distribution. Future visits on a quarterly basis by Dr. Schreiber are anticipated as he continues his monitoring studies.

A major research effort was conducted at the Atoll in September, October, and November. The Hawaiian Undersea Research Laboratory (HURL) brought their submersible MAKALI'I to the atoll for a wide variety of studies. The MAKALI'I, a two-man minisubmarine, is towed to a dive site and then launched from a raft which can submerge to 60 ft. The maximum operating depth of the MAKALI'I is 1,200 feet. Thirty-five dives were made by the sub at Johnston Atoll.

The principle study evaluated potential environmental effects of a proposed offshore dumping site for wastes generated as a result of the JACADS project. These wastes will include salts with heavy metal content, metal bomb casings, and a variety of other materials.

Dr. James Margos, Chief, Environmental Resources Section, Pacific Ocean Division, U.S. Army Corp of Engineers, was the chief scientist for the project conducted under Special Use Permit (SUP JHN 3-83).

Dr. Phillip Lobel (Harvard University) conducted the survey of the two potential dump sites and performed experiments to determine current patterns in the area. In addition, Dr. Lobel surveyed deep and shallow water fish along with Dr. Jack Randall, Curator of Ichthyology at the Bishop Museum in Honolulu, resulting in an annotated checklist of the marine fishes of Johnston Atoll totaling 269 species. Of this total, 82 species were new records for JA. One possible new species was collected.

The HURL submersible MAKALI'I participated in exploratory deep dives off the reef slopes to survey habitats and to study fish populations and the potential impacts of ocean disposal of JACADS and other wastes. GML

Assistant Refuge Manager Ludwig participated in two deep dives as part of a bottom fish assessment on the deeper reef slopes conducted by Dr. Stephen Ralston of the National Marine Fisheries Service. The vertical distribution of fish between 400 and 1,200 feet was examined in this study to determine if a mini-submarine was suitable for commercial bottom fish assessments. Following completion of the submarine surveys, the NOAA ship TOWNSEND CROMWELL conducted experimental fishing for the same species that the sub was surveying. Preliminary analysis indicated a direct correlation of distribution and abundance of the bottomfish found in both surveys.

Fish populations such as these squirrelfish were censused on the deep reef slopes of Johnston Atoll from the HURL submersible. GML

Additional studies conducted from the MAKALI'I included surveys of coralline algae by Catherine Agegian, deepwater fishes and invertebrates (cnidarians and mollusks) by Dr. Edith Chave; corals and reef geology by Dr. James Maragos; and marine geology, sediments, and water chemistry by Dr. Stephen Smith.

Other studies that were conducted in conjuction with the JACADS project included an analysis of the sewage outfall from Johnston Island in May and June by Applied Eco-Tech Services, Inc., of Hialeah, Florida (SUP JHN 1-83). This study determined the levels of bacteria around the island, calculated the amount of effluent, and followed the discharge during several tidal cycles. The results suggested that under the tidal and current conditions present at the time of their study, most of the sewage is carried away from the island and would be unlikely to enter parts of the atoll utilized for recreation. However, they emphasized that additional studies should be conducted during tide and current conditions typical of other times of the year, particularly when wave and current conditions are directed from the outfall toward the island.

During October and November, William Gilmartin, George Balazs, Alan Kam, and Gail Pieterson of the National Marine Fisheries Service surveyed turtle populations (SUP JHN 2-83). They concentrated their work in the area of the sewage outfall on the

south side of Johnston Island. This area has extensive beds of algae (mainly Caulerpa spp.) that are grazed by the turtles. Turtles are seldom seen in other areas of the atoll.

Green sea turtles were captured and tagged by National Marine Fisheries Service biologists to study growth and migration.

Jeffery Roessener of the U.H. Chemistry Department collected moray eels at JA to measure current levels of ciguatoxin (SUP JHN 4-83). Previous studies indicated that ciguatoxin levels were quite high, especially in eels. An outbreak of ciguatera poisoning in humans occurred at Johnston Atoll in the late 1960's. It was suspected that the increased toxicity level was the result of disturbance of the reefs by dredging activities.

1984: Dr. Ralph Schreiber visited the refuge from January 31 to February 7, and performed banding, growth studies, and food habit studies on seabirds. 166 red-tailed tropicbirds, 12 brown boobies, 3 red-footed boobies, and 70 great frigatebirds were banded during this visit. An estimated 60,000 sooty terns were present.

In March and April, Dr. Phillip Lobel of Harvard University continued oceanographic investigations offshore of Johnston Atoll relative to the disposal of JACADS scrubber brines. Drogue studies conducted at the proposed dump sites confirmed 1983 predictions that eddy currents could return material dumped at nearer sites to the atoll reefs. Material dumped within 5 miles

of the south side of the atoll could be transported in a gyre from the south slope back onto the northwest marginal reef.

Dr. Schreiber returned April 2-10 for continued seabird monitoring studies. During this visit, 400 red-tailed tropicbirds, 200 brown boobies, 45 red-footed boobies, 45 great frigatebirds, 300 brown noddies, and 128 white terns were banded. An estimated 320,000 sooty terns were present in the refuge.

From October 3 to October 12, a series of eight drogue deployments concluded the oceanographic studies at the proposed deep ocean dump site for the JACADS scrubber brines. There appeared to be no marked seasonal variation in the current eddy patterns from those found during other times of the year.

Dr. Schreiber returned October 11-23 to complete seasonal sampling. During this visit, 35 wedge-tailed shearwaters, 50 red-tailed tropicbirds, 106 brown bobies, 36 red-footed boobies, 59 great firgatebirds, 40 black noddies and 205 white terns were banded. At this time, only 300 sooty terns were present in the refuge.

Refuge Manager Wass visited from November 8 to November 15 to observe and monitor the release of Hawaiian monk seals (see below), visit seabird colonies, and meet with the Johnston command. Seven of the released seals were observed on JA beaches during the week following their release.

E. ADMINISTRATION

4. Technical Assistance

1983: The Environmental Center at the University of Hawaii and Greenpeace (Seattle), expressed concern about JACADS and inquired about Service policies and regulations that relate to the project. They wanted to know the Service's position on the project and what was being done to insure that environmental concerns were adequately considered. We responded to both, providing information on the history of past relations between the Service and DNA, the applicability of federal laws and the Service's scope of responsibility, and discussed some specific concerns we have about the JACADS project (i.e. sewage discharge, recreational impacts, levels of toxic substancies, etc.). Copies of our letters were sent to POD and USATHAMA and DNA. We also sent a letter to Col. Thiede (POD) outlining these concerns, within the response period following the public meeting.

USATHAMA and POD personnel requested a meeting to discuss Service concerns about JACADS and to resolve differences regarding the type and extent of baseline studies necessary. The meeting was held on May 13. Jack Scott (Project Manager, USATHAMA) and Dr.

James Maragos (Chief, Environmental Section, POD) attended. Scott felt we were raising new concerns (i.e. tissue sampling, baseline water quality) that had not been raised earlier. He also noted that tissue analysis relating to GB, VX, and Mustard gas could run as high as 1/2 to 1 million dollars. He also felt that levels of radio-nucleides and dioxin were irrelevant to the project, because JACADS would have no effects on these. We pointed out that while these concerns had all been raised at earlier meetings and in correspondence, they had never been fully resolved. After considerable discussion, it was decided that Scott would prepare a letter requesting FWS to put together a total "plan" for additional baseline/monitoring studies that would address all project concerns. The plan should also address specific management measures to be incorporated. We agreed that the MOU with DNA should be updated to facilitate possible reimbursable funding. Scott pointed out that USATHAMA would very much like to see FWS behind the project. We noted that much of our concern related to an apparent change in project objective to eliminate only unserviceable munitions rather than all the stored agents. In response, Scott indicated that it is still the project objective to eliminate all materials, but they have not as yet recieved congressional authorization to demilitarize anything but the unserviceable stocks. Scott estimated that it would take 3.1 years (minimum) to demilitarize all munitions. However, this prediction is based on a 3-shift work day with 350 people. If slowed to a 1-shift day (112 people) it would take much longer.

The draft EIS for the JACADS project was received and commented upon by FWS. Meetings were held concerning the setting up of contracts or MOU's for conducting monitoring programs on birds and marine life to determine the possible effects of the JACADS project. Planning and coordination with members of the HURL project was also done.

In September, a coordination and planning meeting for the HURL project was attended at Johnston Atoll by Ludwig and Shallenberger. In addition to coming to agreement on what studies would be conducted by the project, they were also able to collect additional information on population levels of birds at the Atoll. Ludwig participated in the HURL project.

<u>1984</u>: In April, Refuge Manager Wass and Complex Manager Shallenberger participated in the JACADS Environmental Coordination and Status Meeting with Mr. Jack Scott, USATHAMA and COE-POD. The results of several environmental studies were presented and requirements for future investigations were defined. Shallenberger was given the responsibility of coordination with NMFS on continuing studies of the green sea turtles of the refuge. Wass was designated coordinator with the Hawaii Cooperative Fishery Unit on the Aquatic Resources study of the lagoon. The Johnston command's proposed fisheries enhancement structure (artificial reef) was discussed. It was noted that natural reef production is sufficient and creation of

an artificial reef would be for the convenience of the island operators and not a direct benefit to the refuge.

F. HABITAT MANAGEMENT

1. General

Terrestrial habitats on all islands of Johnston Atoll were monitored on the September, 1983, field trip by Complex Manager Shallenberger and Assistant Refuge Manager Ludwig. A similar survey was made during the November, 1984, visit by Refuge Manager Wass.

6. Other Habitats

Marine habitats were surveyed by SCUBA dives conducted by Assistant Refuge Manager Ludwig during September, 1983. Ludwig also participated in deep reef slope dives aboard the MAKALI'I as described above. During the November, 1984, visit of Refuge Manager Wass, lagoon and sand beach habitats suitable for monk seal use were surveyed with Mr. Gene Nitta of NMFS as described below in the endangered species section.

The reefs at Johnston Atoll support luxurient growths of table coral. GML

The first phase of the Johnston Atoll Reef Resources Survey was completed during 1984 with the report dated January 7, 1985. It was conducted by the University of Hawaii Cooperative Fishery Unit (HCFU) under the direction of Dr. James Parrish. The field work was done by Darby Irons and Anderson Dee. A total of 113 stations throughout the atoll were surveyed in a standard manner during January, February, March, and August, 1984. Data were collected relative to bottom topography and composition, including corals and algae. Fish and invertebrate populations were also characterized. The study categorized the Johnston Atoll habitats into 12 zones. The physical and biological characteristics of each were described along with the community structure of the associated flora and fauna. Effort was concentrated on the fish community as that is the resource most likely to be impacted by the JACADS project. The most abundant fishes were found to be members of the parrotfish and surgeonfish families. A catch and effort study of the recreational fishery at JA was conducted concurrently. This study found that the soldierfish was the species most commonly caught. The HCFU study will continue during 1985 and result in a more comprehensive report.

G. WILDLIFE

2. Endangered and/or Threatened Species

The Johnston Atoll population of the threatened green sea turtle, Chelonia mydas, was the subject of a special study by D.W. Gilmartin, G. Balazs, et. al. of the National Marine Fisheries Service (NMFS) in 1983 as discussed above in the research section.

In November, 1984, nine male endangered Hawaiian monk seals, Monachus schauinslandi, which had been captured on Laysan Island in the Northwestern Hawaiian Islands, were transported to Johnston Atoll aboard the NOAA vessel TOWNSEND CROMWELL and released by D.W. Gilmartin and other NMFS researchers. These males had been implicated in "mobbing" behavior which often resulted in the injury or death of females and juveniles. The NMFS researchers and the Hawaiian monk seal Recovery Team both believed the Laysan population would benefit from the removal of the overly agressive males. The seals were tagged and bleach-marked before their release at JA and tracked the week following their release by Refuge Manager Wass and Gene Nitta of NMFS. While at Johnston, Wass also took the opportunity to assure Commodore Kersh and the Base Commander that the presence of the seals would have minimal impact on Base operations and would be unlikly to produce any greater environmental/legal concerns than the existence of the refuge and associated wildlife already provided.

One of the nine Hawaiian monk seal males translocated from Lavsan Island to Johnston Atoll.

3. Waterfowl

There is no wetland habitat on any of the islands of Johnston Atoll, and consequently, little waterfowl. During the September, 1983, visit, one unidentified duck carcass was seen. No waterfowl were noted during the November, 1984, visit.

5. Shorebirds, Gulls, Terns, and Allied Species

The four islands of Johnston Atoll provide breeding and/or roosting habitat for at least 12 species of seabirds. Censuses were conducted by Shallenberger and Ludwig in September, 1983, and working maps prepared of roosting and nesting concentrations. The results are shown on the following tables:

SEPTEMBER 1983 SEABIRD POPULATION ESTIMATES
FOR JOHNSTON ATOLL

Species	Numbers	Remarks
Christmas shearwater	4	2 pairs
Wedge-tailed shearwater	~450	adults and chicks
Red-tailed tropicbird	45	adults and chicks
Masked booby	4	adults
Brown booby	80-100	adults
Red-footed booby	130-170	adults and chicks
Great frigatebird	270	adults and juv.
Sooty tern	~~8000	adults and chicks
Gray-backed tern	50	adults and juv.
Brown noddy	~~5000	adults and chicks
Black noddy	40	adults
White tern	150	adults

SEPTEMBER 1983 SHOREBIRD POPULATION ESTIMATES
AT JOHNSTON ATOLL

Species	Number
Bristle-thighed curlew	2
Golden plover	~95
Ruddy turnstone	~85
Sanderling	8
Wandering tattler	12

The populations recorded in September were lower than the lower of the two 1982 counts for only one species (red-tailed tropicbird), intermediate between the 1982 February and July counts for 6 species (wedge-tailed shearwater, brown and red-footed boobies, sooty tern, black noddy, and gray-backed tern), and higher than the higher 1982 count for 3 species (great frigatebird, brown noddy, white tern). One species seen as one individual on 1982 (least tern) was not seen in 1983, but two species not seen in 1982 were seen in 1983 (Christmas shearwater, masked booby). The effect of the El Nino Southern Oscillation (ENSO) on the seabird populations of Johnston Atoll cannot presently be estimated, although the effect on Christmas and Jarvis Islands was dramatic mass reproductive failure of many species.

In 1984, Dr. Ralph Schreiber and colleagues visited the refuge on several occasions throughout the year and provided estimates on the populations of various seabird species. Because of the

nature of their studies, these estimates are likely to be more accurate than estimates derived from single visits:

TOTAL 1984 SEABIRD POPULATION ESTIMATES
FOR JOHNSTON ATOLL

Species	Number
Christmas shearwater	5
Wedge-tailed shearwater	2400
Red-tailed tropicbird	1830
Brown booby	406
Red-footed booby	860
Great frigatebird	1080
Sooty tern	450,000
Gray-backed tern	40
Brown noddy	3700
Black noddy	140
White tern	850

6. Raptors

No records or sightings of raptors were noted, although a short-eared owl roosting site had been located on Johnston Island in 1982.

11. Fisheries Resources

The Memorandum of Understanding with the Department of Defense allows the taking of fish and other marine resources (invertebrates) for recreational purposes. The Hawaii Cooperative Fishery Unit began an in-depth study of the shallow atoll lagoon and reef habitats and resources in January 1984. The study is funded by JACADS. The objectives are to provide baseline data on the resources and to measure changes in the resource base that might be attributed to the JACADS project whether the causative factors be construction activities, toxic effluents, increased fishing pressure, etc. This study is described above in the habitat management section.

16. Marking and Banding

On the September, 1983, visit of Complex Manager Shallenberger and Assistant Refuge Manager Ludwig, 42 red-tailed tropicbirds were banded and 4 previously-banded individuals were recovered.

Sixteen brown boobies were banded and 20 previously banded birds were recaptured.

As discussed above, Dr. Schreiber and colleagues banded many birds of most species during their study. The following table summarizes their banding results for 1984:

SEABIRDS BANDED BY SCHREIBER AND COLLEAGUES
IN 1984

Species	Number
Wedge-tailed shearwater	35
Red-tailed tropicbird	1,416
Brown booby	406
Red-footed booby	112
Great frigatebird	193
Sooty tern	1,200
Brown noddy	300
Black noddy	40
White tern	343

A red-footed booby chick is banded by Assistant Refuge Manager Ludwig.

H. PUBLIC USE

1. General

Approximately 300 military and civilian contractor personnel were stationed at Johnston Atoll during the reporting period. Recreational fishing and shell and coral collecting are popular activities for island residents. These activities and areas of the atoll open to residents are governed by Base regulations promulgated with the concurrence of Refuge Manager.

9. Fishing

In March, 1983, we received word from Lt. Col. Richard Jolley that a commercial fishing boat was offshore the west reef. They were able to talk to the boat and identified it as the MAGIC DRAGON. The vessel said they were fishing for lobster and ono and that they had received permission from the Coast Guard to be there. Jolley checked with the CG and learned that no such permission had been given. He tried to raise the boat on the radio again, but was unsuccessful. The boat fished the area for about another week and finally left after it was buzzed rather closely by a C-141 seeking to confirm its identification. The incident raised the question of jurisdiction over the waters immediately outside the reef edge. Jolley indicated that, as far as he was aware, DNA had no authority to restrict entry to this area. It is also outside the refuge boundary.

17. Law Enforcement

The incident in March, 1983, which involved the fishing boat MAGIC DRAGON, was investigated, but no prosecution resulted.

I. EQUIPMENT AND FACILITIES

The refuge has no facilities at Johnston Atoll. It does, however, own a 23-foot fiberglass boat which is maintained by the Base Contractor. The boat is used for research and surveys by refuge personnel and visiting scientists.

BAKER/HOWLAND/JARVIS NWR'S

BI-ANNUAL NARRATIVE REPORT

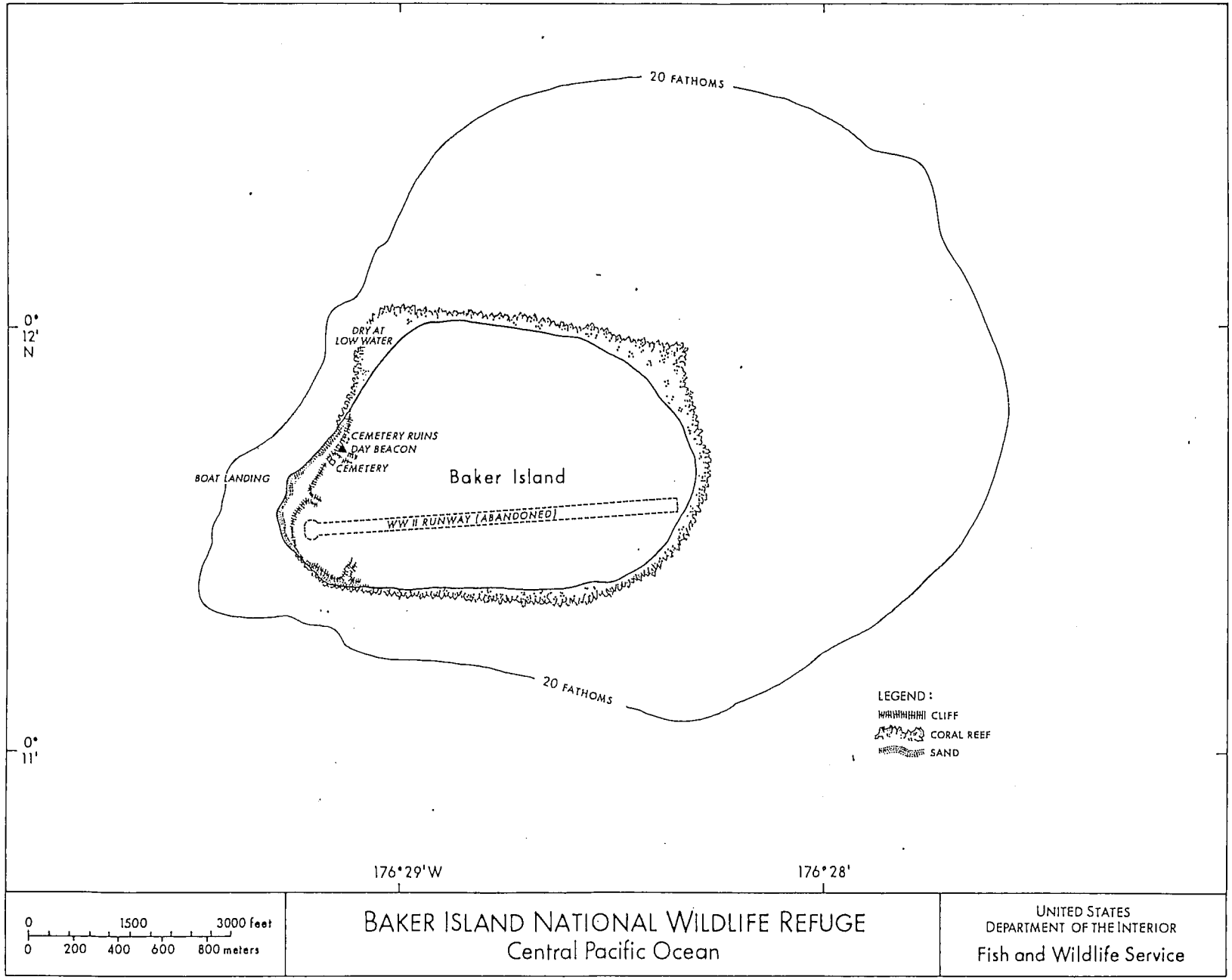
Calendar Years 1983 and 1984

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

INTRODUCTION

Howland Island and Baker Island National Wildlife Refuges are isolated coral islands just north of the equator in the Central Pacific Ocean about 1,600 miles southwest of Honolulu, Hawaii. Jarvis Island National Wildlife Refuge is located just south of the equator about 1,300 miles south of Honolulu and 1,000 miles east of Howland and Baker Islands. Howland Island Refuge contains 400 acres of land and 32,150 acres of submerged land and water. Baker Island Refuge contains 340 acres of land and 31,397 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.

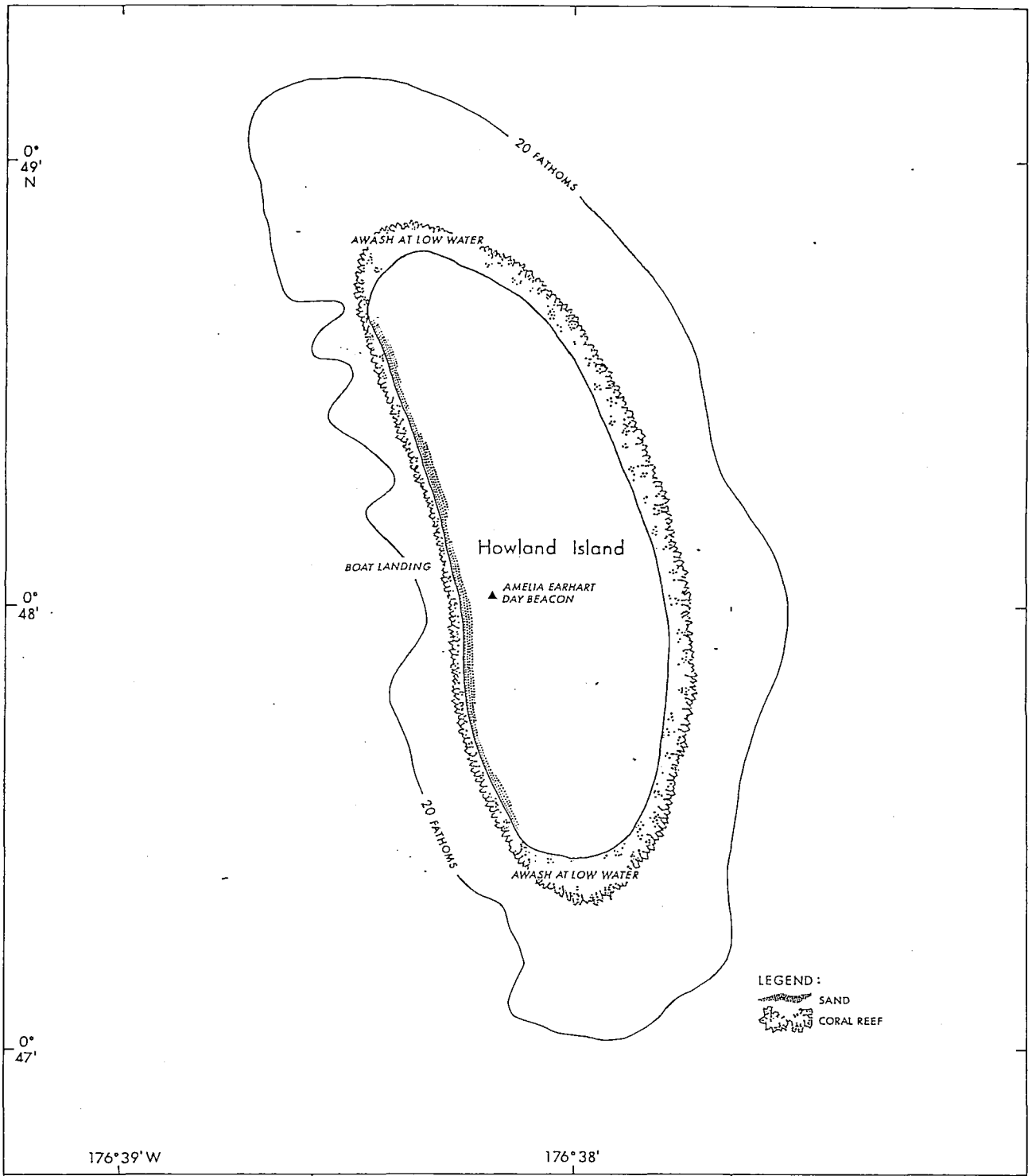
All three refuges were established by the Secretary of the Interior in 1974 when management responsibility was transferred from the Office of Territorial Affairs to the Fish and Wildlife Service. They are managed primarily as nesting and roosting habitat for about 20 species of seabirds and shorebirds.



BAKER ISLAND NATIONAL WILDLIFE REFUGE

Central Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



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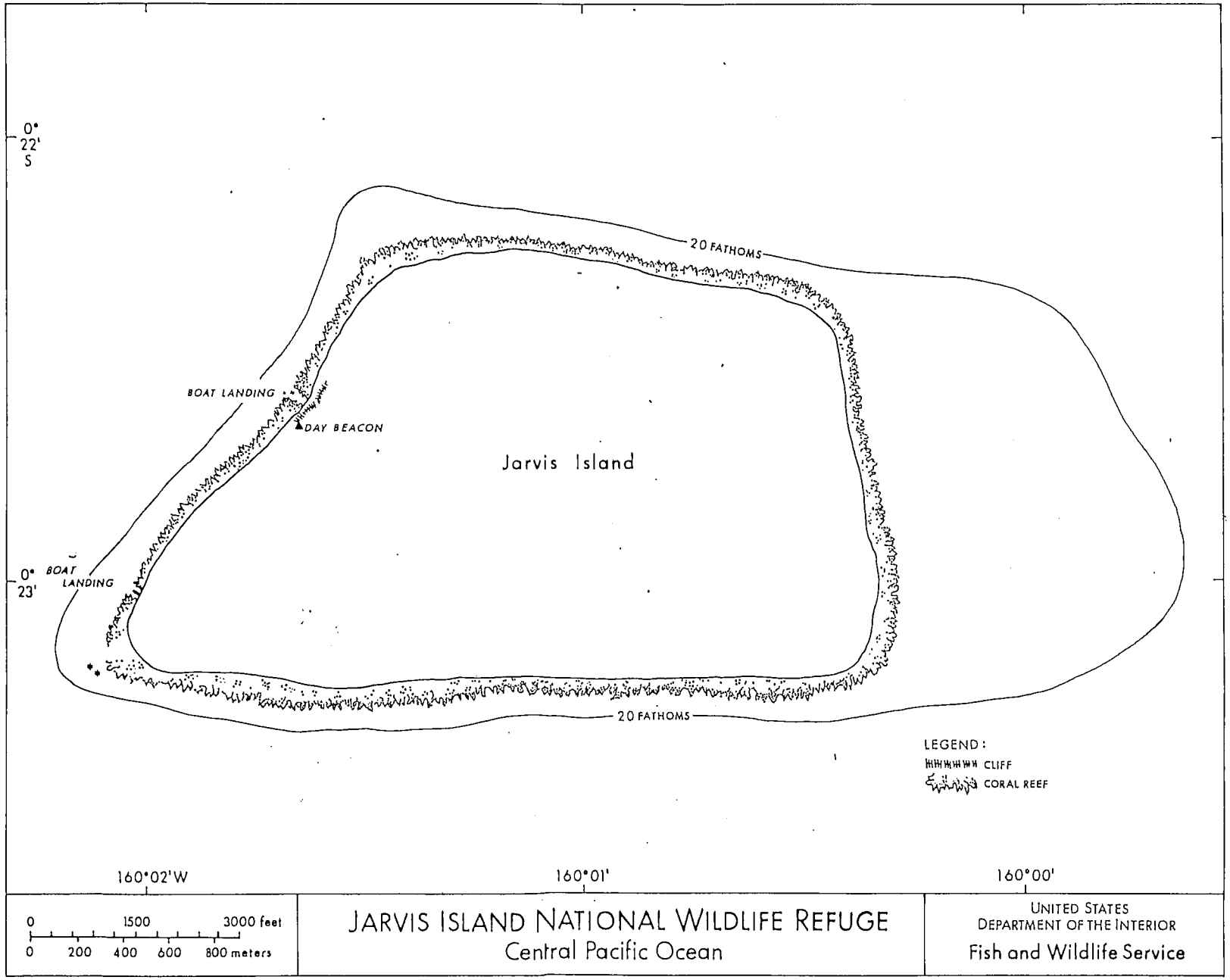
HOWLAND ISLAND
NATIONAL WILDLIFE REFUGE
Central Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service



JARVIS ISLAND NATIONAL WILDLIFE REFUGE
Central Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

BAKER/HOWLAND/JARVIS NATIONAL WILDLIFE REFUGES

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A. HIGHLIGHTS

Two field trips to Jarvis Island took place in 1983. Both of these trips concentrated heavily on the search for feral cats. One cat was sighted during the first trip and none were sighted during the second. A detailed census of vegetation and wildlife was made during the second field trip. The El Nino Southern Oscillation of 1982-1983 adversely affected seabird reproductive success at Jarvis Island. No FWS trips were made to Howland or Baker Islands in 1983 or to any of the three islands in 1984. The only documented landings on these islands in 1984 were by the U.S. Coast Guard, which landed on Jarvis and Howland Islands in October of that year.

B. CLIMATIC CONDITIONS

Climatic conditions at Howland, Baker, and Jarvis Islands are unknown for the reporting period. Weather data were being collected by Dr. Martin Vitousek of the University of Hawaii until March, 1985. Unfortunately, the monitoring instruments were inoperative most of the time, providing little useful information.

The abandoned light at Jarvis Island.

A major warming of the entire eastern equatorial Pacific Ocean has been attributed to the 1982-1983 El Nino and accompanying Southern Oscillation. Oceanic and climatological conditions in the vicinity of Christmas Island (approximately 300 miles NE of Jarvis Island) were reported by Ralph and Elizabeth Ann Schrieber in Science magazine, August 1984, in an article entitled: "Central Pacific Seabirds and the El Nino Southern Oscillation: 1982 to 1983 Perspectives." This subject is covered under the Wildlife section in the context of its relation to seabirds.

D. PLANNING

5. Research and Investigations

Jarvis 1-83 Cat Eradication and Biological Monitoring

David Woodside (Maintenance Worker, FWS) and Katrio Teebaki (Wildlife Conservation Officer, Wildlife Conservation Unit; Kiritiami, Kiribati) spent six days from March 3 to March 9, 1983, on Jarvis Island. This trip was planned as a follow-up on the two cat-eradication trips conducted in 1982. No cats were disposed of on this trip despite extensive day and night hunting and trapping efforts. One positive cat sighting was made, but all attempts to capture it failed.

General vegetation and climatic conditions were noted during the trip, and a bird census was completed.

Jarvis 2-83 Cat, Vegetation, and Seabird Survey and Public Use Monitoring

Dr. Cameron B. Kepler (Biologist, FWS) visited Jarvis Island from November 6 to November 10, 1983. Dr. Kepler had several objectives for his trip: 1) determine if cats were present, and if so, eliminate them; 2) develop an accurate methodology for surveying seabirds on the island; 3) determine populations, size, and breeding status of all resident seabirds; 4) assess the status of vegetation on the island; and 5) supervise the activity of the ham radio operators to ensure compatibility with refuge objectives. No sign of cats was found in over 35 hours of active hunting during periods when cats should have been active. No cat sign was sighted in 11 hours of transect surveys extending 8.15 miles and covering 5% of the island. No predated sooty terns, lesser frigatebirds, boobies, or tropic birds were found. This evidence suggests that cats were probably eliminated though we are not safe in assuming complete eradication until 4 or 5 years have passed with no sign of cats.

Kepler utilized an easily repeatable transect methodology to survey seabirds and vegetation. Detailed information was collected on populations, density, and phenology of nesting seabirds as well as quantitative and qualitative data on habitat. Photos taken from mapped positions will allow for future vegetation monitoring.

This trip was party funded by a group of 4 ham radio operators who made 16,000 radio contacts in 4 days. No adverse effects were attributed to this activity, and it is recommended that such support be used if future cost-sharing opportunities arise.

Jarvis 3-83

A masters thesis entitled, "Feral Cats of Jarvis Island: Their Effects on Seabirds and Their Eradication," was completed by Mark Rauzon (Biologist, FWS) through the University of Hawaii. The research was also published in the Atoll Research Bulletin.

Rauzon, Mark J., 1985. Feral Cats on Jarvis Island: Their Effects and Their Eradication. Atoll Res. Bull. 282:1-30.

Jarvis and Howland 1-84 U.S. Coast Guard Survey

On October 9, 1984, a party from the Coast Guard Cutter JARVIS engaged in a law enforcement partol, landed at Jarvis Island for a general survey. Captain David Worth led the 10-man contingent and filed a report of the visit. They 1) found no evidence of feral cats; 2) noted the vegetation was dry and dying; 3) observed a nesting colony of sooty terns numbering approximately 15,000 with eggs and chicks at all stages of maturity; and 4) remarked on the large population of mice.

The JARVIS also visited Howland Island on October 12, 1984, and landed a shore party of 5 people to conduct a general survey. They sighted one cat and "large numbers" of nesting masked boobies with eggs and chicks at all stages of maturity.

F. HABITAT MANAGEMENT

1. 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. Control has taken two forms: control of introduced cats and destruction of debris. In addition to restoring the islands to their former state (without

destroying historically important artifacts or structures), the natural state of these islands is maintained by a restrictive policy of allowing only activities that would be beneficial to the wildlife populations. The fact that the nearest inhabited island is 240 miles away from Jarvis and 1,321 miles away from Howland and Baker Islands facilitates this type of management.

Remains of the Howland Island camp established to service Amelia Earhart's ill-fated flight from New Guinea.

10. Pest Control

The cat depredation study described under "Research and Investigations" is part of a pest control plan for Jarvis Island. Howland Island also has a small population of feral cats. An attempt to eradicate that population is scheduled for 1986.

G. WILDLIFE

5. Shorebirds, Gulls, Terns and Allied Species

Ralph Schrieber documented reduced reproductive success and probable mortality of adult seabirds at Christmas Island 300 miles NE of Jarvis Island as a result of the 1982-83 El Nino Southern Oscillation. The poor reproductive success and adult

mortality apparently stemmed from a depleted food supply directly related to oceanic conditions which included higher than normal sea surface temperatures. Seabird populations were censused at Jarvis Island twice in 1982 and twice in 1983. The census data are documented in the following table:

	July 1982		Nov. 1982		Mar. 1983		Nov. 1983	
	BP*	Tot.	BP*	Tot.	BP*	Tot.	BP*	Tot.
Wedge-tailed shearwaters	-	100	-	<25	50	100	-	<20
Red-tailed tropicbirds	3000	-	2	0	0	3	16	32
Masked boobies	3000	7000	2	200	0	200	2720	7000
Brown boobies	100	500	2	100	1	250	80	170
Red-footed boobies	0	500	0	250	0	200	22	850
Lesser frigatebirds	-	1500	0	9	0	30	339	700
Great frigatebirds			0	0	0	1?	0	400
Sooty terns	400000	1000000	0	0	0	<100	209000	580000

*BP=Breeding pairs

Eight species were thus known to have bred on Jarvis during the 1982-83 El Nino event. Four species were in the early phases of nesting (eggs and young chicks were present in nests) and all eight of the species were present in July 1982. In November of that year, six of these species were observed in relatively low numbers. None were nesting though there were a few (9) lesser frigatebird chicks that had recently been abandoned and many dead adult and fledged juvenile sooty terns. Nesting was, for the most part, still absent in March 1983 and only low numbers of birds were present. By the November 1983 visit, breeding populations of most species had increased markedly from the low levels of the previous 16-18 months and the increase was expected to continue. It thus appears the El Nino Oscillation markedly reduced the reproductive success of seabirds at Jarvis Island.

Non-breeding shorebirds were also censused during both of the 1983 trips to Jarvis. The results follow:

Species	March	November
Lesser golden plover	24	100
Wandering tattler	4	10
Bristle-thighed curlew	1	5

Their numbers may also have been reduced at Jarvis during the El Nino event.

A family of red-tailed tropicbirds on Jarvis Island.

10. Other Resident Wildlife

Both Woodside and Kepler commented on the large populations of mice present on Jarvis Island during their trips. Woodside estimated that there were several hundred thousand in March, 1983, while Kepler made an estimate of 36,000 using transects and also noted that they were probably going through a population crash.

H. PUBLIC USE

1. General

The November 1983 field trip to Jarvis Island would not have occurred if funding had not been provided by a group of ham radio operators. Although this is not typically recognized as a legitimate use of refuge lands, the knowledge we gained was well worth the exception. This type of activity, if monitored, leaves minimal impact on the resource. It is recommended that future opportunities to share costs with other groups or individuals desiring access to these isolated islands be pursued and utilized.

ROSE ATOLL NWR

American Samoa

BI-ANNUAL NARRATIVE REPORT

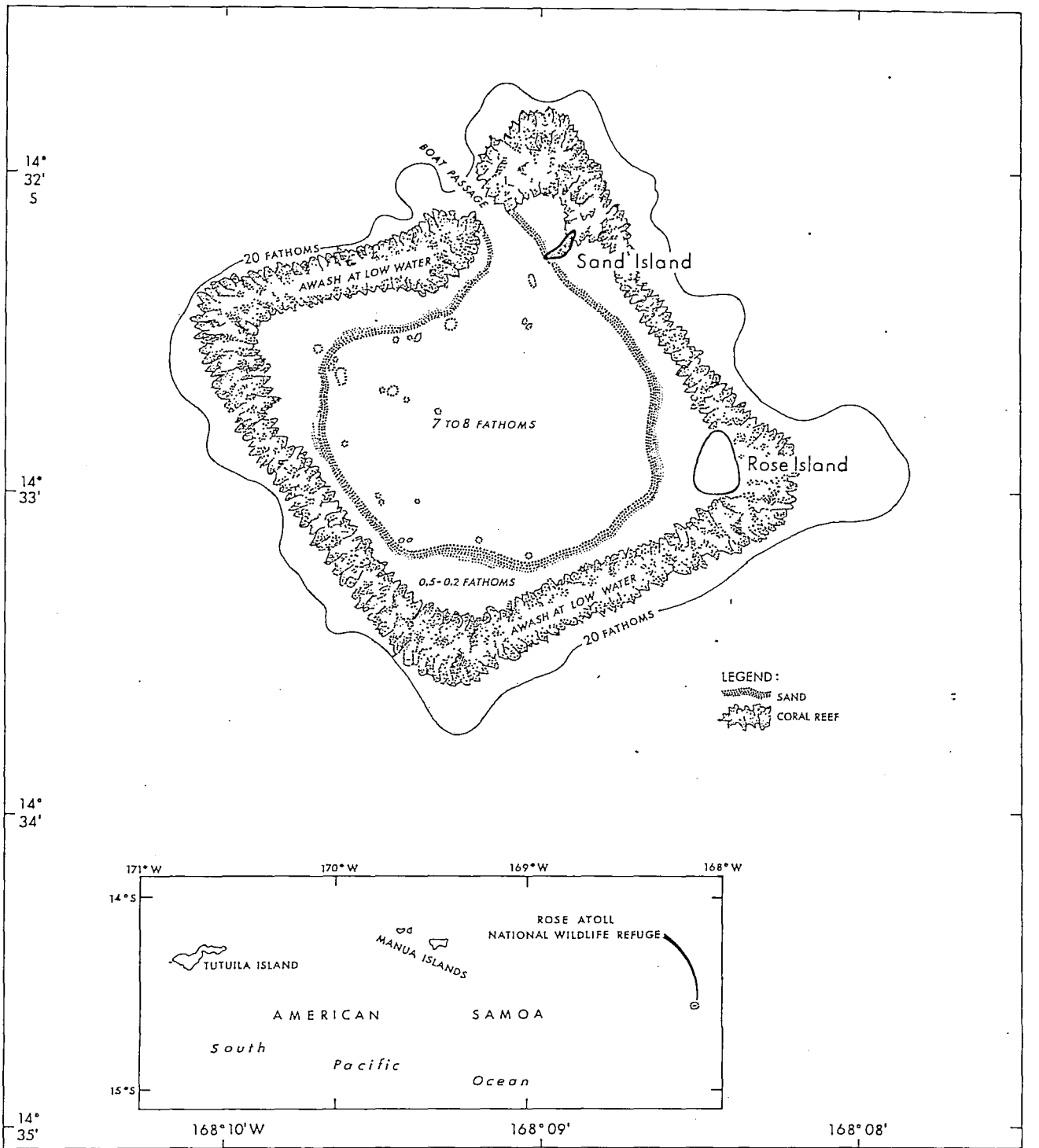
Calendar Years 1983 and 1984

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 fished the nearshore waters.

The Refuge was established in 1973 by a Cooperative Agreement between the Government of American Samoa 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 fish, corals and other invertebrates inhabit the shallow reefs and lagoon.



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ROSE ATOLL NATIONAL WILDLIFE REFUGE

American Samoa
South Pacific Ocean

UNITED STATES
DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

ROSE ATOLL NATIONAL WILDLIFE REFUGE

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A. HIGHLIGHTS

Two field trips were conducted at Rose Atoll during the two-year period covered by this report. They occurred in April and October of 1984. The objectives of both trips were to monitor sea bird and sea turtle populations and to study giant clams.

Dr. Richard Radtke of the University of Hawaii was notified in 1983 that he had received funding from the National Geographic Society to work on Tridacnid clams at Rose Atoll. During both of the 1984 field trips he conducted research on clam growth and ecology.

Paul Pedro, the captain of the research and training vessel (SAUSAUIMOANA) operated by the American Samoa Government, asked a trespassing yacht to leave the lagoon at Rose Atoll. The trespassers stated that the wife of the captain was ill so they had sought a calm mooring for her recuperation.

Tournefortia shrubs were observed growing on the previously unvegetated Sand Island in April, 1984.

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.

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 resources within the Rose Atoll lagoon.

A fisheries stock assessment for the harvest of giant clams (Tridacna maxima) at Rose is being developed from data gathered during the 1984 and previous field trips. This assessment is in response to a request by the Office of Marine Resources, American Samoa Government, to allow harvest by local fishermen.

A nesting pair of masked boobies at Rose Island.

5. Research and Investigations

Research at Rose Atoll has consisted principally of surveys of terrestrial and marine fauna and flora during brief visits to the atoll. No visits occurred in 1983 but two field trips were conducted in 1984.

The April 24-28, 1984 visit by Biologist Fefer also included Dr. Richard Radtke, Janice Bell, Dave Gulko and Fa'asega (Stu) Kuresa. Radtke, Bell and Gulko were from the University of Hawaii and conducting research on the giant clam population. Kuresa was employed by the Office of Marine Resources and represented the American Samoa Government.

The October 21-25, 1984 visit by Biologist Fefer and Refuge Manager Wass again included Dr. Richard Radtke and Janice Bell along with their assistant Cindy Hunter. David Itano, Office of Marine Resources, represented the American Samoa Government and assisted with the coordination.

ROS-1 Tridacnid Clam Fishery Management. A paper on the age and growth of Tridacna maxima was prepared for publication by Dr.

Richard Radtke and Assistant Refuge Manager Ludwig. Planning continued for the eventual management of the clam fishery.

ROS-2 Tridacnid Clam Research. All members of each field party spent at least a portion of their time assisting Dr. Radtke with his clam study. Information was obtained relative to the physical and biological parameters that influence clam distribution including salinity, temperature, currents, depth, substrate composition, angle of orientation to sunlight, population density, and predation. Additional studies included marking and measuring clams to determine growth rates, census and measurement to determine size-frequency, and the collection of shell and tissue samples for laboratory studies of growth rate, age and size at maturity and the factors influencing pigmentation. Dr. Radtke has been contracted to report and analyze these data by early 1986 as part of the FWS's effort to determine the feasibility of opening the refuge to a clam fishery by Samoan nationals as requested by the American Samoa Government.

Giant clams are measured and marked by Dr. Richard Radtke and his assistant, Janice Bell, to study growth rates. RCW

E. ADMINISTRATION

7. Technical Assistance

A series of photographic slides and information about Rose Atoll was supplied to Science Coordinator Rick Davis of the Dept. of Education, American Samoa Government. The slides and information will be used to enhance a traveling exhibit that the coordinator is preparing on the NWR at Rose Atoll.

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 and the lagoon is about one mile across. 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 of the island. The palms were introduced during visits of American Samoan officials during the first half of this century. A die-off of *Pisonia* trees, reported in the mid-1970's, was found to have recovered, with trees in the area of the die-off showing rapid growth. 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 field trip in October, 1982.

Initial colonization by Tournefortia shrubs on Sand Island. RCW

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 oceanic depths and is composed of an extremely diverse coral complex. The inside of the reef crest descends gradually to a rubble dominated reef flat 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 reef flat descends abruptly to about 50 feet and forms the bottom of a one mile (diagonal) wide lagoon. The bottom of the lagoon is principally composed of rubble, sand and small coral patches. Occasional patch reefs reach almost to the surface. A high diversity of fishes and invertebrates is present within the lagoon, but 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.

The considerable sooty tern egg predation noted during October, 1984 was attributed to rats.

G. WILDLIFE

1. Wildlife Diversity

Wildlife resources at the atoll include nesting and resident seabirds, nesting endangered or 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.

Red-footed boobies at Rose Atoll are all dark-phase individuals. SIF

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. During the April, 1984 visit, one green turtle was sighted in the lagoon but there was no evidence of recent nesting activity on Rose or Sand Islands. Considerable nesting activity was observed during the October, 1984 visit. It was estimated that 33 green turtles came ashore at Rose Island during four nights of observation. The survey period coincided with the new moon and high tides so conditions were probably optimal for nesting activity. Five green turtles were double tagged during the survey. One was tagged after it had knocked down a tent erected on the beach. Three nights later, the same turtle came ashore and successfully nested.

5. Shorebirds, Gulls, Terns and Allied Species

Eleven species of sea birds comprise the most prominent group of wildlife within the Refuge. Bird counts were conducted during both field trips. The following table summarizes the number of breeding pairs (BP) and total counts for each species during each trip:

	April '84		Oct. '84	
	BP	Total	BP	Total
Red-tailed tropicbird	15	30	10	-
White-tailed tropicbird	-	3	0	-
Masked booby	15	30	5	-
Brown booby	250	600	8	24
Red-footed booby	450	-	75	400
Great frigatebird	-	50	2	150
Lesser frigatebird	-	15	-	30
Blue-grey noddy	-	0	0	0
Brown noddy	120	266	128	260
Black noddy	365	-	365	730
White tern	225	650	325	700
Sooty tern	3,000	25,000	25,000	-

Biologist Fefer censusing white terns in the Pisonia forest on Rose Island. RCW

Surveys of shorebirds and miscellaneous species were also conducted during both field trips. The results are listed below:

	April '84	Oct. '84
Lesser golden plover	9	30-40
Ruddy turnstone	8	25-30
Wandering tattler	3	5
Bristle-thighed curlew	6	15
Reef heron	1	1
Sanderling	1	2
Long-tailed New Zealand cuckoo	1	1

11. Fisheries Resources

Fishery resources within the refuge include a wide variety of reef fishes, resident and migratory pelagic fish, lobsters and tridacnid clams. Some commercial fishing is conducted for deep 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. Clam surveys are discussed above under the research section.

A green sea turtle is tagged by Biologist Fefer and Refuge Manager Wass after nesting on Rose Island.

16. Marking and Banding

Sixty-seven brown boobies and five red-footed boobies were banded during the April, 1984 field trip. Twelve brown boobies and two red-footed boobies were banded in October, 1984, and five green sea turtles were double tagged.

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 be beneficial.

It is of interest to note that Dr. Richard Radtke, who led the tridacnid clam research effort during 1983 and 1984, is afflicted

with multiple sclerosis. Though able to move about quite well under water due to the bouyancy of his body, he was unable to walk or get in or out of the boats on his own. In spite of his handicap, he was able to successfully conduct field research in a very remote location. Credit is also due to his wife, other members of the field party and to the crew of the SAUSAUIMOANA for lifting Dr. Radtke in and out of boats, for carrying him back and forth to his wheelchair and for assisting with the many personal tasks people normally handle for themselves.

Multiple sclerosis has not prevented Dr. Radtke from participation in Rose Atoll field trips to conduct research on giant clams. RCW

6. Interpretive Exhibits/Demonstrations

Biologist Fefer and Dr. Radtke were interviewed on Samoan television during the April, 1984 visit. Seabird, turtle and clam monitoring studies and research were discussed and the value of the refuge as protected nesting habitat for turtles and seabirds was stressed. Assistance in the form of photographic slides and information was supplied to the science coordinator of the Dept. of Education, American Samoa Government.

Biologist Fefer and Dr. Radtke are interviewed by an American Samoan newsperson following their field trip to Rose Atoll.

17. Law Enforcement

The captain of the SAUSAUIMOANA, a fishing vessel operated by the Office of Marine Resouces, American Samoa Government, observed an illegally moored yacht within the lagoon and, hence, within the refuge boundary. Advice was sought from FWS Law Enforcement personnel to determine if the yacht captain should be cited for trespass. Because of the nature of the situation (sick personnel), it was decided the trespass was justified and nothing was done beyond informing the Captain that he had violated the law.

Whenever the refuge is visited by FWS or American Samoa Government personnel, the islands are searched for evidence of illegal entry such as campsite remains, butchered turtles or recently harvested clam shells. No indication of illegal entry was found during either of the 1984 field trips.

KILAUEA POINT WILDLIFE ADMINISTRATIVE SITE

Kilauea, Hawaii

BI-ANNUAL NARRATIVE REPORT

Calendar Years 1983 and 1984

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

INTRODUCTION

The Coast Guard lighthouse at Kilauea Point, Kauai, was built in 1913. The light, visible for more than 20 miles, was placed on the most northern tip of Kauai primarily to warn ships passing between the mainland United States and the Orient. The FWS occupied the 33-acre site under an annual permit from the Coast Guard beginning in 1974. This was the same year that the historic light was replaced with an automated light system. The lighthouse and 3 residential buildings were then excessed by the Coast Guard. Final transfer of property to the FWS occurred in December, 1984. The Kilauea Point NWR is the major interpretive facility for the refuge complex. Visitors are afforded scenic views of the coastline as well as close-up views of many seabirds. The refuge is open 6 days a week, Sunday through Friday, from 12-4 p.m. The refuge also supports a wide diversity of resident and transient seabirds. Of the 22 seabird species known to breed in the Hawaiian archipelago, 14 have been observed at Kilauea Point and seven of these have been seen on a regular basis. Green sea turtles are regularly observed. Marine mammals observed include humpback whales, spinner dolphins, and the endangered Hawaiian monk seal. The refuge has been undergoing a habitat restoration project to clear exotic vegetation and replant native coastal plants.

Kilauea Point, lighthouse, and 33-acre wildlife administrative site. RWR staff.

KILAUEA POINT WILDLIFE ADMINISTRATIVE SITE

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A. HIGHLIGHTS

1983: The Kilauea site is owned by the U.S. Coast Guard and managed on a yearly permit by the U.S. Fish and Wildlife Service. The property is in the process of being excessed by the Coast Guard and transferred to the Service. In July, Mr. Frank Southwick, GSA, San Francisco, and Coast Guard property personnel visited the site. GSA later prepared a report favorable to the transfer.

On March 29, a U.S. Army helicopter crashed into the water approximately 200 feet west of the lighthouse. Salvage attempts required several days and involved up to 25 people. Several inquiries were held to determine the cause and details of the crash, which involved the interviewing of refuge staff and EARTHWATCH volunteers. Service employees assisted all efforts.

To better service the expanding public visitation to the site, a Park Ranger (Interpretive) position was created in February with duties to include increasing interpretive programs, developing a volunteer program and the formation of a cooperative association.

1984: After nine years of annually renewable tenure, GSA transferred the 32-acre Kilauea Point Administrative Site property from the U.S. Coast Guard to the U.S. Fish and Wildlife Service on December 19, 1984.

A formal volunteer program was initiated at Kilauea Point on January 20, 1984. A total of 93 persons completed two, 20-hour interpreter's training sessions sponsored by the Service.

Sixty-six persons participated in volunteer programs at Kilauea Point. The newly renovated visitor center is served entirely by volunteers.

A cooperating association sales outlet opened its doors to the public on April 16, 1984. Utilizing 100 square feet of the visitor center and staffed entirely by volunteers, the Kilauea Point Natural History Association realized $9,601.31 in net revenues derived from sales, memberships, and contributions.

On December 11, following four years of manipulating habitat to attract prospecting Laysan albatross onto Kilauea Point, 2 nests were reported on the site.

B. CLIMATIC CONDITIONS

1983: Maintenance and clean-up activity continued into CY 1983 as a result of Hurricane Iwa, which struck the island on November 23, 1982, causing 200 million dollars damage and severing water,

electric, and telephone service for over a month. Removal of fallen trees on refuge properties continued until summer. Some areas of the island were still not fully functional by the end of CY 1983.

Weather data for Kilauea Point:

Month	Rain (inches)	Temperature High	Temperature Low	Winds (mph)
January	6.0	78.4	66.3	10.5
February	3.7	77.4	65.3	11.2
March	3.7	77.2	66.1	11.9
April	3.2	78.2	67.3	12.4
May	3.4	80.0	69.2	11.9
June	2.0	82.2	71.0	12.5
July	2.7	83.0	71.8	13.0
August	3.1	83.8	72.3	12.5
September	2.4	84.6	72.5	11.2
October	4.6	83.3	71.5	10.9
November	6.5	80.7	69.8	11.7
December	5.3	78.6	67.8	11.3
TOTAL	46.6	80.6	69.2	11.8

1984: The first 3 quarters of 1984 could be characterized as unseasonably dry. The drought required the irrigation of open lawn areas and areas with native planting.

The last quarter of 1984 brought the resumption of normal winter rainfall.

Strong winds in December did minor damage to roofs and vegetation.

Month	1984 Rain (inches)	30 year Average Rainfall	Temperature High	Temperature Low	Winds (mph)
January	3.44	7.1	79.5	68.1	13.0
February	3.75	5.6	79.0	68.4	14.5
March	4.16	8.2	82.4	68.0	12.8
April	8.01	6.1	81.5	71.2	17.8
May	4.56	5.2	83.0	73.3	15.5
June	3.26	3.4	84.0	74.5	16.9
July	3.96	4.7	85.0	75.2	14.2
August	1.39	4.6	85.5	78.0	11.9
September	3.92	4.1	85.0	78.0	11.9
October	3.25	5.4	83.3	71.5	10.8
November	15.62	7.1	80.7	69.8	11.7
December	11.85	6.9	78.6	67.8	11.3
TOTAL	67.17	68.40	82.3	72.0	13.5

C. LAND ACQUISITION

1. Fee Title

1983: On July 28, Mr. Frank Southwick, GSA, San Francisco; Neil Erickson, USCG, Property Branch, Honolulu; Captain Schaeffer, USCG, Property; and Tim Titus, USCG Attorney, inspected the Kilauea site to prepare recommendation for excessing ultimate transfer of the property to the Service.

Mr. Southwick prepared a report favorable to the Service's acquisition of the property. Negotiations continued to the end of the year.

1984: After years of negotiations, the Kilauea Point Wildlife Administrative Site was conveyed from the U.S Coast Guard to the U.S. Fish and Wildlife Service. National Register listed public benefit, historic properties and the presence of migratory birds were influencing factors. The Coast Guard will maintain access and easements for their aids to navigational equipment.

3. Other

1984: Robertson-Larson Partnerships commenced development of their nearby property. After a publicly unpopular action to move the development to an area which would adversely impact the refuge and community views, the developer is again seeking management of a 300'-400' wide conservation-zoned coastal strip.

A nearby community group, the Kilauea Community Association, has approached state legislators seeking possible joint State and Federal involvement in the area.

The proposed development to bring residences to the top of Crater Hill, which would impact Kilauea Point, was denied on December 12 by the Kauai County Planning commission.

Larry Coe, Realty, Portland, visited KPW on February 16. He briefed the staff on KPW property excess procedures and inspected the site's facilities. Mr. Coe was briefed on the adjacent Crater Hill property should the Nature Conservancy or developer want to enter into a tenure agreement with the Service.

D. PLANNING

2. Management Plans

1983: A Habitat Management Plan and map of existing vegetation

was prepared in December.

1984: Regional I&R Senior Staff Specialist, Dick Kuehner, visited Kauai in mid-January to conduct public use planning sessions in the field.

In early spring, Keuhner produced preliminary plans offering several options. Although not complete, considerable thought and additional planning options have evolved.

4. Compliance with Environmental Mandates

1983: Shallenberger and Moriarty attended a Cultural Resources Management meeting in Corvallis, Oregon, October 24-28.

Laysan Albatross

Pacific Missile Range Colony: Refuge staff worked with military personnel at Pacific Missile Range, Mana, Kauai, to monitor a new colony forming on the base as concerns arose about the increased possibility of air strikes to military aircraft by this large seabird. Refuge staff developed a plan to remove newly hatched chicks and hand-rear them at the Kilauea Point facility using their newly formed volunteer group.

Kilauea Point Laysan Albatross Attraction: Large open "courting areas" were developed on the protected Kilauea Point Refuge site. Obstructing exotic trees were reduced in size and decoys constructed by the volunteer EARTHWATCH were employed to increase the attraction to the site. "Courting birds" utilized the site during the later part of the 1982-1983 season and the early part of the 1983-1984 season.

N.E. Kauai Colonization Attempts: A total of 18 nesting attempts were monitored during 1983. Only one nest survived to 1984. The remainder were killed by dogs. A total of 47 birds were banded and 32 dog kills were recorded. Refuge staff worked with land owners and dog owners in the area in an attempt to protect nesting sites from dog predation.

Newell's Shearwater

Newell's Shearwater Fledgling Recovery: Refuge staff manned 3 Newell's shearwater aid stations on Kauai's north shore. Staff checked aid stations DAILY and retrieved fledgling Newell's shearwater chicks which were dropped off at the station by concerned citizens. "Recovered" birds were banded, weighed and released at Kilauea Point. 150 birds were recovered.

Cross-fostered Newell's Shearwater Nesting Site Monitoring: Newell's shearwater eggs were cross-fostered by wedge-tailed shearwater adults in experiments conducted by refuge staff in

1978, 1979, and 1980. As these chicks are now approaching sexual maturity, staff monitored the rearing areas in hopes of a recovery. A banded cross-fostered chick was recovered in June. Circling and calling birds were reported several times during the summer.

1984: A volunteer historic research committee chaired by Audrey Pricher has been able to uncover a wealth of information on the Kilauea lighthouse. In addition to its historic value, the information obtained by the group has been of great value in developing interpretive materials.

Historical documents obtained through the efforts of the volunteer committee include: Eight photographs circa 1911-1913, depicting construction of the lighthouse and residences; four 1930 photographs depicting the radio beacon and light; over 25 photographs from 1960-1980; several early post cards, circa 1950's-1975; interviews with former lighthouse keepers and local residents; and the original Bureau of Lighthouses blueprints of the lighthouse.

During February, March, and April, Coast Guard contractor repaired and painted the lighthouse.

E. ADMINISTRATION

1. Personnel

1983: Assistant Refuge Manager Brady transferred to Pahranagat NWR on April 3, 1983. Maintenanceman Moriarty was transferred to the newly created Park Ranger position with new duties to include expansion of the Kauai Refuge Complex's interpretive programs, formation of a cooperating association and development of a volunteer program. The maintenanceman position was filled on a temporary basis by William Lemn until May when he left to return to farming. Richard Bottomley completed the year on a temporary appointment. Wetlands Assistant Manager Coleman transferred to a position in Washington D.C. in July. A new replacement was unavailable for the remainder of 1983.

1984: The staff consistent throughout the year consists of:

Dan Moriarty - Park Ranger
Noreen Bautista - Clerk-typist
Richard Bottomley - Maintenance Worker

Jim Krakowski replaced Rick Coleman as Refuge Manager (Wetlands) in January.

Jerry Leinecke replaced Rob Shallenberger as Refuge Complex Manager in August.

2. Youth Programs

1983: A six week non-residential YCC camp was held at Kilauea Point from July 5 to August 26. Six enrollees and a work leader hired under the Student Conservation Association completed a number of projects on the site, including reestablishment of native vegetation, painting of refuge buildings, removal of exotic vegetation, fencing and predator trapping.

1983 YCC enrollees removing noxious weeds at Kilauea Point. RWR staff.

1984: A non-residential Youth Conservation Corps camp was held on Kauai from June 10 to August 3. Damien Baptiste was hired as YCC Crew Leader under the Student Conservation Association and supervised 6 enrollees.

A GSA station wagon and refuge pick up truck picked up and returned enrollees to the designated pick-up point at Kilauea Post Office.

Projects completed by the 1984 YCC enrollees included: Removal of exotic weed species, nursery work, preparation and painting of station facilities, expanding lower parking area, painting concrete wall and utility building, and general maintenance.

Environmental education was included in the program by daily work-related instruction and formal instruction.

In 1984, YCC enrollees made major improvements to the outside nursery. RWR staff.

4. Volunteer Program

1983: EARTHWATCH, a non-profit organization which seeks to assist in field research, sponsored 2 field researchers and 3 groups of 10 people each of 2-week stays to assist with the Laysan Albatross Attraction Project and other refuge tasks.

In addition to EARTHWATCH participants, a few interested volunteers assisted in staff projects such as banding, Laysan albatross monitoring, and nursery work. A large scale volunteer program is scheduled for early 1984 to consolidate training and to avoid having to conduct training sessions for small groups.

1984: Prior to January 19, 1984, there had only been a handful of volunteers on the Kauai refuges. Those that participated as volunteers were generally transitory and did not remain in Hawaii.

In early 1984, a concerted effort was made to attract and train volunteers from the Kauai community primarily to assist with the public use program. To that end, a news release was placed in the local newspaper and a meeting was scheduled on January 19. Eighty persons attended the first of the 10-week, 20-hour training sessions, which focused on the geology, history, plants, and wildlife associated with the Kilauea refuge.

Most of the volunteer training was held in the small interpretive building adjacent to the lighthouse.

A total of 47 persons completed the training, which coincided with the opening of the newly renovated visitor center and cooperating association sales outlet on April 16.

The visitor center has been staffed entirely by volunteers, usually with 3 persons on duty during open hours. While on duty, one person answers questions from the public, one conducts sales for the Kilauea Point Natural History Association, and the third person conducts informal interpretive sessions pointing out current wildlife activities.

In addition to their visitor center duties, volunteers have assisted in nursery work, landscaping, bookkeeping, stock ordering for the KPNHA, obtaining historical information on the Kilauea Lighthouse, a Laysan albatross captive rearing project, and field participation in bird banding and censusing.

A second 20-hour volunteer training class was held from September 26 to December 5. A total of 22 persons completed the course.

6. Safety

1983: Regular safety meetings were conducted throughout the year, including both staff and volunteers. Unsafe and hazardous conditions were noted and corrective actions taken. In April,

CPR training was successfully completed by all staff members and several volunteers.

1984: Periodic safety meetings were conducted by Safety Chairman Bottomley. Unsafe and hazardous conditions were discussed and corrective measures taken. Bottomley has placed safety posters in appropriate locations and rotates them monthly.

All staff members and several volunteers have completed CPR and multi-media First Aid.

Emergency procedures to safely and effectively facilitate fire, police, and ambulance response at Kilauea Point were developed with the agencies involved. Each volunteer was briefed as to the procedures.

Bottomley completed Basic Fire Management Training on December 7.

All staff members and YCC Work Leader completed Defensive Driving Course on May 31.

7. Technical Assistance

1983: On June 30, Norm Holgerson, Wildlife Biologist, Animal Damage Control, California, visited Kauai. He was briefed on the following refuge predation problems: myna bird/wedge-tailed shearwater egg predation; dog, cat, owl, cattle egret and black-cfowned night heron predation; and winter coot damage to taro fields.

1984: In early 1984, Kilauea refuge staff worked with State of Hawaii biologists to evaluate concerns by U.S Navy staff at Pacific Missile Range, Mana, Kauai, about potential air strikes eminating from a small Laysan albatross colony at the edge of the runway.

Biological and safety concerns led to the eventual translocation of 8 chicks to Kilauea Point (see Laysan Albatross).

The problem emerged again in late 1984. This time, arrangements were made to translocate the chicks to Sea Life Park in Honolulu.

Navy staff were extremely cooperative in controlling dog predators, flagging nests to prevent accidental destruction by maintenance and military activities, and monitoring nests between staff visits.

8. Other

1983: On June 1, evaluations for the Kauai Refuges was conducted by Larry DeBates, Assistant Regional Director (AWR), Dick Bauer, Senior Staff Specialist (PD), Harvey Lee, Program Analyst (PD), Rob Shallenberger and Rick Coleman.

1984: On March 8, refuge revenue sharing check for $15,025 was presented to the Treasurer, County of Kauai.

F. HABITAT MANAGEMENT

1. General

1983: After the disturbance of the Coast Guard facilities development, the vegetation of Kilauea Point consisted primarily of weedy vegetation, much of which provided little habitat for the native seabirds.

Refuge efforts started in 1979 and assisted by YACC/YCC, concentrated on the propagation and reestablishment of the native coastal species, especially those species utilized by nesting seabirds.

1.7 acres of new native plantings were established on refuge property.

1984: In lowland Hawaii, the trend in the last 100 years has been the introduction and expansion of thousands of exotic plant species. When the Service commenced management of the Kilauea Site, it began a program to reverse this trend by attempting to control exotic species and to propagate and restore the native coastal plant species. The management objectives of this effort were:

1. To conserve these plant species.

2. Many of the native species were preferred by the resident seabirds for nesting.

3. To make available native coastal species for educational purposes.

4. To use native coastal species in attractive landscape design to encourage the public to appreciate and use native species.

Areas restored in 1984 included the entrance to the Kilauea Point facility, an unsightly hill below the office, several badly eroded gullies along the entry road, and a weeded area above the nursery. Volunteers and civic groups assisted in the nursery propagation and actual planting.

The public has responded with many favorable comments about the grounds, however, the most rewarding response to these efforts was the ultimate attraction of the Laysan albatross onto the refuge on December 11. The removal of large weedy tree species and the maintenance of seeward-facing open grassy knolls were

responsible for the attraction of prospecting albatrosses.

A total of 12,300 square feet of Scaevola, a native coastal shrub, was established. Over 160 Pandanus trees were planted and 1750 square feet of grassed area was established as part of the restoration project.

6. Other Habitats

1983: 150 hala trees (Pandanus sp.) were planted on refuge property in an attempt to encourage red-footed booby nesting.

Fifty large exotic Ironwood trees (Casuarina) trees were removed to encourage Laysan albatross courtship and ultimate nesting.

1984: About 35 large Casuarina trees were cut back to the base to allow the Laysan albatross better access to the grassed knolls. The reduction of these large competitive trees resulted in an expansion of the less aggressive native species in the area.

The limbs and trunks of these trees were removed to areas of extensive weedy growth and burned, thereby further reducing the weed population.

10. Pest Control

1983: An increase in dog predation due to urbanization and the closing of a local cattle operation, which controlled feral dogs, was noted this year.

Dogs have killed 32 Laysan albatross, approximately 25 red-footed boobies, and several hundred wedge-tailed shearwaters on adjacent, non-refuge lands. Refuge involvement here consists mainly of attempting to contact local dog owners and the occasional hunting of destructive animals. Control is difficult due to populations, dense brush, and nocturnal habits.

Two incidents of dog predation were recorded on the refuge. Entry was made through a hurricane-damaged fence section. Fence repairs and increased hunting pressure has eliminated predation.

Cats have not been seen on the refuge since late summer.

Shooting pressure was applied toward myna birds during the wedge-tailed shearwater incubation period with considerable success.

G. WILDLIFE

2. Endangered and/or Threatened Species

1983: Newell's Manx Shearwater - Refuge personnel participated in the cooperative salvage, banding, and release program with the State Division of Fish and Game. Many young shearwaters, after leaving their burrow nests in the central mountains, would become disoriented by bright lights along the coastal roadways as they headed to sea. These shearwaters would fly into powerlines and buildings and end up on the ground, unable to regain flight. Local citizens would take these downed birds to holding areas to await pickup by State or Federal biologists.

The refuge staff assisted with these pickups and banded the birds before releasing them at Kilauea Point. The following table indicates the great success of the Newell's manx shearwater retrieval program.

Year	Number of Shearwaters Retrieved and then Released
1978	867
1979	1,377
1980	1,358
1981	1,123
1982	1,412
1983	1,560

Green Sea Turtle - Four to six threatened green sea turtles are regularly seen in the waters surrounding Kilauea Point. None were observed hauled out on the rock ledges, as they do on the uninhabited islands further west of Kauai.

1984: Newell's Townsend's Shearwater - Now a threatened species, the Newell's shearwater was once found on all main islands. The Newell's Townsend's shearwater is only known to nest on the steep mountain slopes of Kauai. Between 1978 and 1980, ninety eggs were removed from the wild and placed under wedge-tailed shearwater chicks at Kilauea Point. As reported in a paper published in the Journal of Wildlife Management, 48(1):1984, hatching success of the transplanted eggs over the three year period was 78.9%, and over 94% of those chicks were reported to have fledged.

During the summers of 1982-1983-1984, staff residing at Kilauea Point reported repeated calling and circling of Newell's shearwater in the vicinity of the residences.

In 1984, calling was documented from 5/6/84 to as late as 9/3/84.

In addition to the reported nocturnal activities at Kilauea, three banded former cross-fostered chicks were recovered in the area. Those recoveries are as follows:

7/11/83	Kilauea Point	#0584-15420
7/6/84	Kilauea Point	#0584-17153
9/2/84	Anini Beach	#0584-17167

All three recoveries were apparently attracted to lights, crashed, and released alive.

In the expectation that the calling and circling Newell's shearwater may attempt to nest, staff constructed the entrance of the burrows in which the chicks were reared with plywood "excluders" with openings of 3 1/2" x 3 1/2", 3 1/2" x 4 1/2", and 3" x 3 1/2".

The excluders were designed to keep out the larger, more competitive wedge-tailed shearwaters, while allowing the smaller Newell's shearwater to enter and utilize the burrow.

In no instance were the Newell's shearwaters observed in the area in which they were reared.

The wedge-tailed shearwaters were able to enter even the smallest enclosure (3" x 3 1/2"), however, excluded burrows of all 3 sizes were not utilized in about 50% of the 37 burrows.

Newell's Shearwater Fall Recovery - Each fall, fledgling Newell's shearwater chicks leave their mountain burrows and become disorganized by lights along the coast and strike trees and wires, after which they fall to the ground. A joint USFWS and State of Hawaii program started in 1979, directing the public to bring downed fledglings to "aid stations" located conveniently throughout the island. Service and State of Hawaii personnel picked up these chicks, weighed, banded, and released them at protected release sites.

A total of 188 fledglings were recovered at three north shore stations.

A total of 1,125 Newell's shearwaters were collected at aid stations on Kauai and released. A total of 117 birds were reported dead on Kauai's highways.

5. Shorebirds, Gulls, Terns, and Allied Species

1983: Wedge-tailed shearwaters are the most numerous bird species at Kilauea Point. Approximately 4,000 shearwaters inhabit the site from mid-March to November. During a nest survey in September, 1978, 1,671 nesting burrows were located at Kilauea Point. About 54% of these burrows were considered to be active.

Wedge-tailed shearwater nesting success was studied through bi-monthly monitoring of 50 randomly selected burrows. Biologist Fefer commenced a Refuge Complex Growth Rate Study, which included 35 Kilauea Point chicks.

280 wedge-tailed chicks were banded at fledgling time, a production level lower than in previous years.

The red-footed booby colony of 800-900 birds nest primarily on the eastern edge of the refuge. The colony location was gradually moving further east and off the refuge as the trees and other vegetation, which supported the nests, began to die back. This dieback appeared to be associated with heavy bird use and accumulation of bird feces. Hurricane Iwa (11/23/82) inflicted further damage to these trees, which will probably accelerate the eastward relocation of this booby colony.

An estimated nesting population of 12-16 white-tailed tropicbirds and 12-20 red-tailed tropicbirds is also found at the Point. Another common seabird seen on this site is the great frigatebird, with high summer counts of 40-200 birds.

Laysan Albatross - In the last 10 years, this large migratory seabird has attempted to expand its normal northwest Hawaiian nesting range to include Kauai and volcanic islands off the Coast of Japan. Courtship activities are commonplace on northeastern Kauai between November and April. However, nesting attempts have generally met with failure due to dog and human disturbance. Several birds have nested at Pacific Missile Range on the southwest end of Kauai. Efforts by the Base Commander have eliminated the "wild dog" problem; however, as this small colony increases, the threat of air strikes to military aircraft will increase.

1984: Wedge-tailed Shearwater - On March 20, the first returning wedge-tailed shearwater was observed at Kilauea Point. Courtship and burrow construction was reported in April and May. More egg laying took place in June.

Fifty random nests were selected and monitored to determine success. The first egg was observed hatching on July 27. The majority of eggs hatched the first two weeks of August.

Between November 8 and 12, a total of 510 chicks were banded.

Fledging started about November 15. By months end, most chicks had fledged. A few remained into early December.

This was a very successful year for the wedge-tailed shearwater. Very little myna bird predation of eggs was noted, no dog predation observed,and very little owl predation. Human disturbance was reduced to a minimum by fencing and volunteer presence.

Red-tailed Tropicbird - Commencing in May, red-tailed tropicbirds carried on their courtship displays in the front of the lighthouse. From 5-10 birds were involved. A second group of 10-20 courting birds were seen off the booby colony. Several nests were observed at the top of the peninsula.

By the end of October, all chicks had fledged Kilauea Point. Birds were not seen during the winter.

White-tailed Tropicbird - In May, the number of white-tailed tropicbirds increased at Kilauea Point. At times, up to 10 individuals were seen, especially in the late summer when adults and fledglings were observed.

An accessable nest was located in a gully on the western rim of the Point.

By early winter, one or two white-tailed tropicbirds were seen occasionally.

Brown Booby - A species not known to nest at Kilauea Point, but often seen roosting and flying in the area. Up to 10 adults were observed on Mokuaeae Island on a regular basis throughout the day and especially in the evenings.

Red-footed Booby - On February 12, the red-footed boobies began collecting nesting materials. A few eggs were observed in late March. In April, the adults were incubating eggs. Hatching had occurred by early June.

In early August, fledglings were observed flying about the lighthouse. 377 sub-adults were censused in the colony in early August.

Several injured sub-adults were turned into the refuge in early fall. By mid-fall, the sub-adults were generally absent from the colony.

Great Frigatebirds - Although not known to nest at Kilauea Point, great frigatebirds are resident throughout the year, their numbers sometimes reaching several hundred. This increase coincides with chick rearing activities of the red-footed booby on which they are cleptoparacitic.

In the winter, spring, and fall, resident populations were from 25-50 birds. Summer populations range from 75-200 individuals in the area. Many birds roost at Mokuaeae and in trees below the crest of Crater Hill.

On occasions, great swirling masses of up to 100 birds are seen in the sky above Crater Hill.

Laysan Albatross - Prior to 1975, the Laysan Albatross was known to nest on Kauai in historic times. Nesting was known on Niihau and some central Pacific Islands, however, the highest

concentrations of nesting was reported in the northwestern Hawaiian Islands.

Commencing in 1976, Service personnel have continued to monitor Laysan albatross nesting attempts on Kauai. Our 1984 efforts can be summarized as:

Monitoring Northeast Kauai Nesting Sites:

By early February 1984, the 15 known northeast Kauai Laysan albatross nesting sites had failed due to dog predation. Periodic checks in late winter revealed that pre-nesting courtships had expanded to Princeville, however, little activity was noted east of Mokolea Point. Periodic checks of former northeastern Kauai sites at the beginning of the 1984-1985 season failed to turn up any nesting outside of Kilauea Point. On December 11, two active nests were reported at Kilauea Point.

Monitoring Pacific Missile Range Nesting Sites:

A total of 14 nests were observed at Pacific Missile Range in early 1984. Concerns about air strikes, the inability to protect the birds from dog predation, and avian pox resulted in the translocation of 8 chicks to Kilauea Point on February 8 and 10. On February 22, dogs gained access to the colony and killed 30 birds. A few birds were seen in late spring.

The 1984-1985 nesting season began with the sighting of a bird on November 13. By November 30, there were 5 active nests. By December 27, 14 active nests had been recorded. Nesting adults and pre-nesting birds were documented and recovery forms sent to Honolulu.

Laysan Albatross Attraction, Kilauea Point:

Prior to the 1983-1984 nesting season, several large Cassuarina trees were cut down to allow unobstructed aerial access and seaward visibility from the previously cleared knolls.

The recorded vocalizations employed in 1982-1983 were not utilized. The two and three dimensional decoys were randomly placed on all grassy clearings on the refuge. Birds continued to select the largest cleared area including two new areas recently cleared. The decoys appeared to offer little attraction in marginal areas.

In December 1984, prior to the 1984-1985 nesting season, several tall trees were removed and decoys were not employed. On December 11, two active nests and an inactive but recently built nest depression were recorded.

Nesting Laysan albatross at Kilauea Point NWR. RWR staff.

Translocation and Hand-rearing of Pacific Missile Range Chicks at Kilauea Point:

Prior to the 1983-1984 nesting season, there were only a handful of nests at Pacific Missile Range, presenting few problems. In 1984, the number of nesting birds increased dramatically to 14. In addition, an influx of non-breeding birds were noted.

Wildlife and Navy officials became concerned that a build-up of birds along the runway would pose a hazard to aircraft. State, Federal and Navy personnel collectively decided to move the newly hatched chicks to Kilauea Point and attempt to hand-rear them using a cadre of volunteers.

On February 8 and 10, eight newly hatched chicks were translocated to Kilauea Point where they were fed a diet of mascerated squid, cod liver oil, saline solution and vitamin supplement.

Five of the chicks died within a few days, however, the three remaining chicks grew to over 3,000 grams and developed adult plumage. Despite their development and weight, the chicks mysteriously died a few weeks before the time they would be able to fledge. Despite their ultimate death, some success was realized in the weight gains and physiological development of the chicks.

At all locations, birds were banded. Recapture reports and banding reports were submitted.

Volunteers get some hands-on work rearing Laysan albatross. RWR staff.

6. Raptors

1984: A peregrine falcon, an occasional migrant to Hawaii, was seen in December harassing red-footed boobies and, on one occasion, a great frigatebird.

9. Marine Mammals

1983: Humpback whales are sometimes seen from the Point as they migrate to and from their winter calfing areas between the main islands.

Spinner dolphins are often seen in the quiet water in the lee (west side) of the Point.

Hawaiian Monk Seal

Two sightings of Hawaiian monk seals were reported from the cove, one on November 13 and one on December 18.

These are the only sightings in the area since 1978. A report was sent to National Marine Fisheries Service.

Humpback Whales

Humpback whales were observed at sea from Kilauea Point during the months of January, February, March, April and into early May. After an absence of sightings during the winter and fall months, individuals were first observed on December 6.

In December, the interpretator/volunteers began to use a National Marine Fisheries Service Shore Spotters log to record the frequency and activity of whales seen from the lighthouse.

Spinner Dolphins

From 60-120 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.

1984: Moriarty participated in a National Marine Fisheries Service sponsored Mammal Stranding committee in September.

11. Fisheries Resources

The clear ocean waters surrounding the Point contain a wide assortment of reef and shore fishes typical of remote coastal areas in the main island group. No qualitative or quantitative studies have been made to further assess this resource.

14. Scientific Collections

1984: A selection of bird species found in Hawaii was given to Dr. Stanley Harris, College of Natural Resources, Humboldt State University, Arcata, California, to be used in the student collection.

15. Animal Control

1983: Myna bird/wedge-tailed shearwater egg predation: Chicken eggs laced with household ammonia failed to reduce myna bird predation of the newly hatched eggs. Refuge staff secured the necessary State permits and controlled the myna birds with firearms.

1984: The predator fencing, which encloses dogs from the peninsula portion of the refuge, was improved throughout the year. Storm damaged sections and water course undercuts were repaired. Diligence on the part of volunteers and staff kept visitor-owned pets controlled.

Some mid-summer dog predation was noted in the red-footed booby colony on adjacent property. There was no dog predation observed on Service managed lands. Three uncontrolled domestic and feral dogs were shot, including a white Akita which was observed on adjacent property killing Laysan albatross. It had also killed over 200 wedge-tailed shearwaters, including several on the refuge in 1983.

Five cats were trapped and sent to the Kauai Humane Society for disposal.

Approximately 100 rats were trapped at Kilauea Point.

In previous years, up to 20% predation of wedge-tailed shearwater eggs by the introduced myna birds had been documented at Kilauea Point. Under State of Hawaii permit, the myna population was reduced by shooting prior to egg laying. In 1984, 20 mynah birds were taken prior to egg laying. Predation of the eggs was reduced to less than 1%.

16. Marking and Banding

1983: A total of 240 young wedge-tailed shearwaters were banded at Kilauea Point just prior to fledging.

Refuge personnel assisted with banding and release of Newell's manx shearwaters during 1983 (see Section G.2).

A total of 42 Laysan albatross were banded on Kauai in 1983.

1984: A total of 87 Laysan albatross were banded in 1984 and a total of 510 wedge-tailed shearwaters were banded during the period.

A total of 188 Newell's shearwaters were banded by U.S. Fish and Wildlife Service staff under a State of Hawaii permit.

17. Disease Prevention and Control

1984: In March, Fefer took serological samples from 3 captive reared Laysan albatross at Kilauea Point No blood parasites were evident.

Staff monitored Laysan albatross and wedge-tailed shearwater for symptoms of avian pox.

Two cases of avian pox were detected in wedge-tailed shearwaters prior to fledging and in early November.

H. PUBLIC USE

1. General

1983: Public use declined slightly in early 1983 due to a decrease in mainland visitors advised of storm damage to the island which was inflicted by Hurricane Iwa. Visitation returned to normal and register increased over the previous year by late CY 1983. Notable increases were recorded in the utilization of refuge interpretive services by local school and community groups.

To provide the visitors interpretive experience, a cooperating association and volunteer group was formed.

Several local and national media presentations featured Kilauea Point, including National Geographic, Honolulu KGMB Channel 9, KHET TV Superintendent of Education Report to the State, The Hawaii Public TV Broadcasting Network, A Day in the Life of Hawaii, and a range of Hawaii tourist publications.

A total of 190,663 persons visited the refuge in 1983. An estimated 47,666 persons viewed the refuge during closed hours from the overlook constructed at the entrance to the site.

1984: Public use increased 51% from the previous year. The visiting public appears to appreciate the volunteer interpreters who help answer their many questions. The public also appreciates the selection of natural history items available at the KPNHA Shop as it presents to them the opportunity to better understand the unique environment.

Two national media presentations featured Kilauea Point, including WTBS Portrait of America and Sunday Morning News with Charles Kuralt of CBS.

A total of 288,434 persons visited the refuge in 1984. An estimated 63,112 persons viewed the refuge during closed hours from overlook at the entrance to the site.

A list of groups given an orientation to the U.S. Fish and Wildlife Service and Kilauea Point is attached.

2. Outdoor Classrooms - Students

1983: Kilauea Point has become increasingly popular with school groups as a convenient location to study weather, seabirds,

history, oceanography, and botany.

A YMCA residential-camp located 10 miles west of the refuge conducts an active year-round camp which takes in local school groups for 5 days of wildlife exploration. Visits to Kilauea Point and Hanalei NWR are included in this program. The refuge staff conducts an annual training program for the camp leaders. A total of 540 students are involved in refuge visits through this program.

Total visitation to the refuge by school groups for 1983 included 14 class visits and a total of 815 individual students.

1984: Public use by students increased from 815 students in 1983 to 1,947 students in 1984.

A total of 150 students visited the refuge through the YMCA program. The residential camp, located 10 miles west of the refuge conducts an active year-round camp which takes in local school groups for 5 days of wildlife exploration. Visits to Kilauea Point and Hanalei NWR are included in this program. Refuge staff conducts an annual training program for the camp leaders.

Kilauea Point has become increasingly popular with school groups as a convenient location to study weather, seabirds, history, oceanography, and botany.

Ranger Moriarty interprets for visiting school students.
RWR staff.

3. Outdoor Classrooms - Teachers

1983: The Park Ranger meets on a regular basis with public and private school teachers to assist in planning the proposed field trips to the refuge. Specific visit objectives and pre-visit informational packets are given to teachers.

An informal field trip evaluation is conducted after each visit.

1984: The Park Ranger continued to meet with teachers on a regular basis to assist in planning the proposed field trips to the refuge. Specific visit objectives and pre-visit informational packets are given to teachers.

A total of 55 teachers were given an orientation to the Fish and Wildlife Service and Kauai refuges.

6. Interpretive Exhibits/Demonstrations

1983: Assistant Manager Coleman and Refuge Manager Shallenberger developed a photographic and narrative display for the interior of the visitor center featuring the northwestern Hawaiian Islands, Hawaiian waterbirds, the remote refuge islands and endangered island wildlife. Many favorable comments were received from the public after intallation of the display in mid-1983.

An interpretive display was constructed as a response to visitor curiosity concerning Laysan albatross decoys in open areas along the visitor trail. The display utilizes 3 photographs and 2 typewritten panels to briefly explain the lift cycle of the albatross and the intent of the attraction study.

1984: The volunteer history committee developed a display of historic pictures depicting the development of the Kilauea Lighthouse and buildings. Significant changes in vegetation are also documented in the photographs.

7. Other Interpretive Programs

1983: On March 19, a special National Wildlife Week program was held at the refuge. Five hive hundred persons attended the afternoon series, which offered an opportunity to view the Laysan albatross through a spotting scope, 2 slide presentations, an exhibit of coastal plants, and a general orientation to the refuge.

Approximately 140 persons attended the Hawaiian Night Sky Astronomy lecture held at Kilauea Point on August 10. Louis Valier, astronomy docent at Bishop Museum, was the speaker.

Refuge staff conducted several programs off the refuge at the request of school and community groups. Included in these requests were four 2-hour programs held at Kilauea School, a

Sierra Club presentation in Lihue, and a wetlands presentation at St. Theresa School, Kekaha.

A total of 368 persons benefited from refuge staff presentation of the refuge.

A total of 40 written inquiries were received and replies prepared to students and persons planning to travel to Hawaii.

A promise of $2,000 start-up loan from the Arizona Memorial History Association was negotiated by refuge staff.

1984: Refuge staff conducted several programs off the refuge at the request of school and community groups.

Moriarty conducted a lecture for the Kauai Museum on the subject of coconuts and led a field trip for the Sierra Club at Mahalepu.

A total of 76 written inquiries were received and replies prepared to students and persons planning to travel to Hawaii.

The U.S. Fish and Wildlife Service was mentioned approximately 47 times in the two Kauai newspapers during the year. (The Garden Island mentions Kilauea Point hours weekly.)

Two volunteer training sessions were held during the year. Both classes lasted 10 weeks for a total of 20 hours.

The U.S. Fish and Wildlife Service was mentioned in approximately 30 drive guides and visitor publications distributed at many restaurants, gift shops, and airports.

9. Fishing

1983: Local fishermen use steep trails on the refuge property to gain access to the State of Hawaii-owned shore line. Ocean access is considered a right in Hawiian tradition and guaranteed under the Hawaii State constitution. Fishermen are required to check into the refuge office and sign a waiver which informs them of the dangerous trails.

Expansion of fishing access is not advisable.

1984: A total of 98 fishermen signed the waiver informing them of dangerous trails on refuge property. Number of access per person ranges from once a year to 30 times a year.

11. Wildlife Observation

In the last few years, there has been an increase in refuge visitation by small specialized groups such as museum, college, or university sponsored Hawaiian History tours, Audubon Chapter

sponsored birding tours, and specialized commercial wildlife tours such as Nature Expeditions International and Questers.

17. Law Enforcement

1983: On April 27, a shooting occurred on the adjacent property west of the refuge in which the suspect held a hostage for several hours. Refuge staff assisted police efforts to contain the suspect who later surrendered after killing his hostage.

Moriarty attended Basic Law Enforcement Training in FLETC April 24 to June 22.

1984: The high public use has created a situation requiring law enforcement presence to reduce minor infractions such as parking to block the safe flow of traffic, speeding, entering closed areas of the refuge, trespassing, low-flying aircraft over the refuge, drinking, dogs in closed areas, traffic accidents, and vandalism.

In the "nuisance catagory" are infractions such as climbing barrier fences, playing radios loudly, loud motorcycles, parking cars during peak visitation hours, and miscellaneous disturbances.

As most of the infractions are caused by transients who do not reside on Kauai, little long-term public use management is gained by prosecution of these minor infractions, however, they do reuire staff attention.

Moriarty attended Law Enforcement Refresher Training in San Francisco.

18. Cooperating Association

1983: To better service the rapidly expanding public use, a cooperating association called the Kilauea Point Natural History Association was formed on September 18. A seven member board was recruited in early spring. By September, organizational meetings were held, officers elected, a constitution was developed and passed, committees were formed to deal with membership, finance, shop, and by-laws.

The organization petitioned the State of Hawaii for a non-profit corporate status which was granted November 23, 1983.

Norman Steenhof, local architect, drew plans for the portion of the visitor center to be used by the association for display of books and publications.

1984: In late 1983, a cooperating association board was organized and by-laws were drawn up and submitted to the State of Hawaii for approval. The following is a summary of the 1984 cooperating association activity:

On November 28, 1983, the State of Hawaii received the necessary documents to petition the State for status as a non-profit corporation with stated education/interpretive objectives. The State conveyed their final approval to the association on January 7, 1984, however, they back-dated the date of incorporation to November 28, 1983.

On January 12, 1984, the association filed with the Internal Revenue Service to obtain the required 501 (c) (3), Tax Exempt Status as a non-profit organization. IRS approval was received on April 10, 1984.

On January 27, 1984, the association approached the USFWS to enter into a Memorandum of Agreement to use a portion of the Visitor Center as a sales outlet. Both parties finalized the MOA on February 22, 1984. To protect both parties, a $100,000 liability insurance policy was obtained by the association from the First Insurance Company of Hawaii effective April 16, 1984.

During the month of March, the interior of the Visitor Center was renovated in accordance with Architect Steenhof's design. A total of $1800 of Service money was expended for materials and labor. During renovation to the Visitor Center, the Shop Committee obtained book catalogs and commenced selection and ordered books. A board meeting was held in March, at which time specific financial procedures for the shop's operations were introduced and adopted. The Visitor Center, with the newly completed and stocked KPNHA sales outlet, was opened on April 16.

At its inception, the KPNHA had no funding available for membership brochures, postage, envelopes and sales outlet stock. Refuge staff approached the Arizona Memorial History Association on Oahu and, on February 3, it secured a $3000 interest-free loan payable in two installments over the next two years. Using the $2000 loan, a membership brochure was developed and memberships in the association were solicited from mailing lists borrowed from local chapters of groups such as Audubon, Sierra Club, Kauai Historical Society, etc.

After the April 16 opening of the sales outlet, brisk sales turned over existing stock very rapidly. Stock was reordered and subsequently sold. As the cash flow increased, new titles were added and existing stocking levels were increased.

Gross sales for 1984 were $17,138.94. The items sold included 2,546 books (77 title selections), 637 plastic guide cards, 268 USGS topographic maps (17 maps available), 5,971 post cards, 74 fish posters, 10 calendars, and 233 Kauai Reference Maps.

In addition to revenues generated by shop sales, the KPNHA raised a total of $2,135 from the membership program. The membership categories and dues structure of the Association allows for the following memberships: $5 Individual, $10 Family, $50 Business, $100 Patron or Corporate.

Some of the privileges the members enjoyed during the year included: Special members only pre-Christmas sale at KPNHA shop allowing for a 20% discount, membership cards, and 2 newsletters sent out in 1984.

As the association has obtained the proper IRS approval to receive contributions as legitimate tax deductions, it has been given $2,940.00 in contributions in 1984. The bulk of these contributions were received in the name of the late Norman Steenhof. Mr. Steenhof and his wife, Barbara, were instrumental in the formation of the Kilauea Point Natural History Association. Mr. Steenhof, a well-known architect, designed the interior of the Visitor Center and gave considerable personal support to our formation. Upon Mr. Steenhof's untimely death in February, the family requested that in lieu of flowers, donations in his name be made to the Association. This unselfish gesture resulted in the accural of $2,940 from Norm's many friends both in Hawaii and on the mainland.

It is the intention of the board at the proper time to consult with Mrs. Steenhof to select an appropriate and enduring purpose to use the funds in Mr. Steenhof's memory.

I. EQUIPMENT AND FACILITIES

1. Construction

1983: With the assistance of the County of Kauai, Hanalei Baseyard staff and equipment, a leaking 2" galvanized iron waterline and rusted sand filter were removed from the refuge entrance. 150' of new 2" diameter PVC pipe was installed 2' below grade and the turn-around area, a traffic bottleneck and safety hazard, was enlarged 40'. The County backfilled the area with crushed coral and installed temporary curbing to prevent slipping until funding allows proper paving of the area.

The nursery area was improved by construction of redwood headers and by filling the floor with crushed rock.

The interior of the visitor center was renovated to accomodate the Kilauea Point Natural History Association sales outlet.

2. Rehabilitation

1984: The U.S Coast Guard issued a contract to Quality Builders for the sandblasting, chipping, closing-in, and repainting of the original Kilauea Lighthouse. Work took place in February, March, and April.

New lighting fixtures for Quarters #1 and Quarters #3 were ordered and delivered from Home Improvement Center. Installation of fixtures is planned for early 1985.

4. Equipment Utilization and Replacement

1984: Dave Woodside inspected the refuge John Deere tractor and trailer for possible use in Honolulu or excess. The John Deere farm tractor was transferred to Honolulu on December 14.

On May 30 and 31, Moriarty assisted the Coast Guard several times in their attempt to resolve problems with Aids to Navigation Light. It appears that a combination of faulty light bulbs and a faulty light switch caused problems for several days.

6. Energy Conservation

1984: In March, bids were solicited to convert Quarters #1 and #2 to solar water heating.

J. OTHER ITEMS

3. Items of Interest

1984: Kilauea Point was mentioned in three National Geographic publications, "Our Threatened Inheritance", "Wild Lands for Wildlife", and "Our Federal Lands".

The April issue of Sunset Magazine carried a small one-page article on the Kilauea Lighthouse which included a photograph of the lighthouse and the "birds only" sign.

In June 1984, the FAA included Kilauea Point as a noise-sensitive area and recommended in its notice to airmen that a height of 2,000 feet be maintained over the refuge.

On August 21, Honolulu Star Bulletin Editor, Lois Taylor, collected information for a news item on the lighthouse and refuge. Despite a few inaccuracies, it conveyed a positive image.

Turner TV Network, Portrait of America Series, requested and was granted a Special Use Permit to film on the refuge on September 24. They filmed great frigatebirds and other native birds.

Paul Chelsey, National Geographic photographer, photographed wildlife scenery at Kilauea Point intended as a portion of the revised Hawaii Book to be published in 1985.

A five-minute segment of wildlife photographed at Kilauea Point and Hanalei National Wildlife Refuge was featured at the end of the CBS Charles Kuralt, Sunday Morning show which appeared on KGMB TV on December 30. The film included red-footed boobies, Hawaiian stilts, wedge-tailed shearwater chicks and the U.S Fish and Wildlife Service, Hanalei NWR and Kilauea Point.

Girl Scout Council of the Pacific released their 1985 calendar in December. Included in this calendar is a photograph of Kilauea Girl Scout Troop 655 at the Kilauea Point Overlook.

Don Knowles, House Department of Interior Budget Staffer, inspected Kilauea Point on February 13.

Jim Leopold, Budget Officer, USFWS Washington, visited Kilauea Point on June 19. Mr. Leopold inspected Hanalei, Huleia, and Kilauea Point.

Regional Director Myshak visited Kilauea Point in October.

Robert Gilmore, Associate Director of Federal Assistance, visited Hanalei NR and Kilauea Point on November 28.