

HAWAIIAN ISLANDS  
NATIONAL WILDLIFE REFUGE  
HONOLULU, HAWAII

ANNUAL NARRATIVE REPORT

Calendar Year 1990



Red-tailed Tropicbird [DKM]

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

REVIEW AND APPROVALS

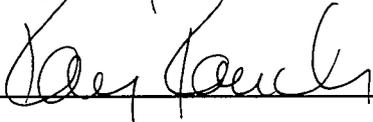
HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

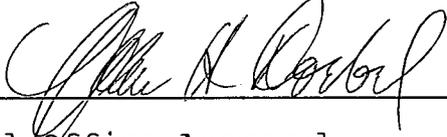
Honolulu, Hawaii

ANNUAL NARRATIVE REPORT

Calendar Year 1990

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Refuge Manager, Pacific/Remote Islands NWR Complex Date

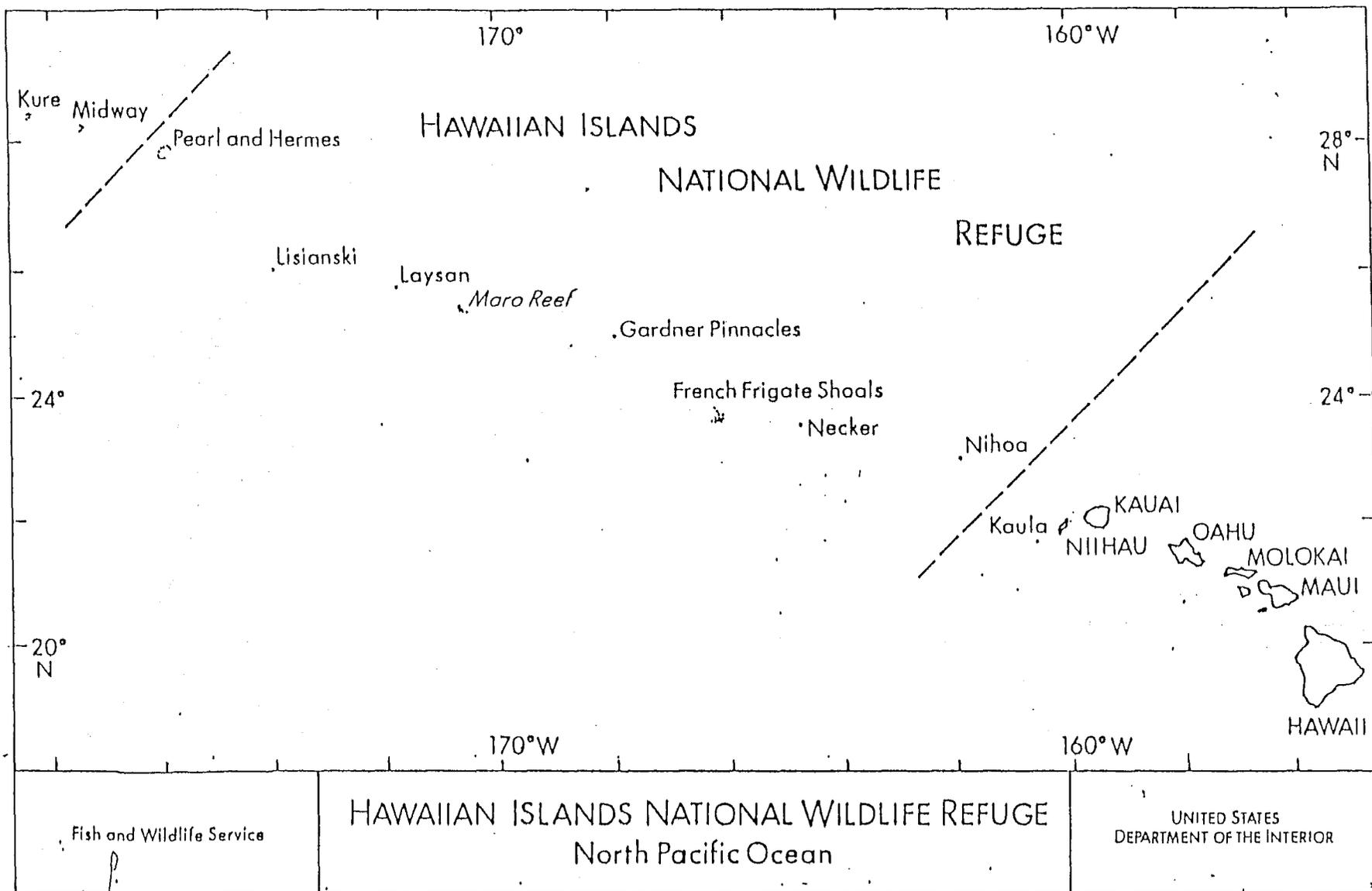
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Project Leader, Hawaiian & Pacific Islands NWR Complex Date

 2/25/94  
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Regional Office Approval Date

## 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 (See Figure 1). Emergent lands total approximately 1,740 acres. The Fish and Wildlife Service considers another 252,700 acres of submerged land to be within the Refuge. Nihoa and Necker Islands, Gardner Pinnacles, and La Perouse Pinnacle at French Frigate Shoals are the cores of old volcanic cones. Sheer cliffs of basalt and the absence of beaches are typical of these islands. Laysan and Lisianski Islands are low, flat sand islands surrounded by submerged fringing coral reefs. French Frigate Shoals and Pearl and Hermes Reef are true atolls. Each has several small sandy, partially vegetated islets encompassed within a fringing coral reef. Maro Reef has only a couple of small coral heads protruding a few feet above the surface of the ocean. Only one of the islands in the Refuge is presently inhabited. The Service 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. The Refuge also has a .23 acre Administrative Site in Honolulu, known as Kapahulu. The site is composed of a warehouse and bunkhouse. Most operations are conducted from an office in the Federal Building in downtown Honolulu.

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



HAWAIIAN ISLANDS NATIONAL WILDLIFE REFUGE

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## A. HIGHLIGHTS

TV New Zealand sends a three-man film crew to Laysan Island and French Frigate Shoals (Section H.1).

Four Hawaiian monk seal pups are born and weaned on Tern during 1990 (Section D.5).

The break in the north sea wall on Tern Island widens and uncovers an underground diesel fuel storage tank (Section F.6).

John Twiss, Executive Director of the Marine Mammal Commission visited Tern Island in March (Section G.9).

A survey crew from the Regional Office visits Tern Island in September to begin surveying for the shore stabilization project (Section F.6).

A Refuge-wide survey of introduced ant species is completed (Section F.10).

A survey of terrestrial invertebrates was conducted on Nihoa Island by a Bishop Museum researcher (Section D.8).

The Refuge continued to rely heavily upon congressionally appropriated funds (Section E.5).

Pearl Pacific Air pilot Bob Justman completed his 200th flight to Tern Island (Section I.8).

## B. CLIMATIC CONDITIONS

The portion of the Hawaiian Archipelago included in the refuge extends from Nihoa Island (23° 03'N, 161° 55'W) to Pearl and Hermes Reef (27° 47'N, 175° 49'W). Weather conditions vary within these latitudes, but, generally, conditions are tropical to subtropical with fairly constant northeast trade winds.

Tern Island, French Frigate Shoals weather information is collected two ways, for different purposes. A remote weather station transmits data to a satellite on a hourly basis for use by the National Weather Service. These data are used only for marine weather forecasting, so no long-term records are maintained. Tern Island refuge staff operate a weather station for long-term records. Minimum and maximum temperatures, wind velocity and direction, barometric pressure, precipitation, and cloud cover are measured and recorded on a daily basis.

Table 1. Tern Island 1990 Weather Data.

Month	Mean Temperature (°F)			Mean Wind (kts)	Total Rain (in)
	Max.	Min.	Daily		
January	75.6	66.5	71.0	13.6	4.24
February	73.4	64.4	68.9	15.0	0.83
March	74.8	65.0	69.9	12.6	1.52
April	76.7	65.9	71.3	10.5	1.99
May	78.1	66.2	72.2	13.1	0.95
June	81.1	69.0	75.1	14.0	1.89
July	82.5	69.0	75.8	12.3	1.08
August	84.7	73.9	79.3	11.3	0.85
September	84.9	77.4	81.2	10.1	1.00
October	81.1	76.2	78.7	14.7	3.75
November	75.9	72.1	74.0	15.4	7.67
December	75.9	69.8	72.9	14.5	2.22
Mean	78.7	69.6	74.2	13.1	27.99 ----

The hottest temperature recorded was 87.0 degrees F on 20 September. The coolest temperature recorded was 58.0 degrees F on 27 February.

Average wind velocity was 13.1 kt. Mild to moderate trade winds (from the northeast) prevailed throughout the year. Winds during winter months were more variable, influenced by major storm systems. Storms with wind velocities of 30 to 55 kts. were recorded in January, February, March, November, and December.

Total precipitation for 1990 was 27.99 inches. The highest rainfall occurred in November with 7.67 inches recorded. February, which was last year's wettest month, had the least precipitation, with 0.85 inches recorded for the month. The highest daily rainfall total was 2.87 inches on 7 November. We recorded more than an inch of rain 4 times in 1990.

A review of annual precipitation figures for Tern Island since 1981 indicates a mean annual precipitation of 29.4 inches.

**Table 2. Annual  
Precipitation for Tern  
Island, French Frigate  
Shoals 1981-1990.**

YEAR	TOTAL PRECIPITATION (in.)
1981	32.1
1982	37.4
1983	19.6
1984	32.7
1985	33.0
1986	33.0
1987	17.0
1988	25.1
1989	36.0
1990	28.0
MEAN ANNUAL	29.4

Historical data collected during military occupation from 1954 to 1962 recorded a mean of 45.29 inches per year. These data indicate a 35% decrease for mean annual precipitation for the area. Climatic perturbations, such as El Nino events, have significant impacts on the ecology of the refuge.

Because refuge personnel are only able to make short visits to most of the Refuge islands, they often return with a snapshot view of habitat conditions. Personnel who make trips to the refuge islands over the course of several years, gain an understanding of how profoundly climatic perturbations can affect insular ecosystems. Rainfall and severe storm events which cause over-washing of some small islets can significantly alter the appearance of an island. The lesson for managers is to be cautious with hands on management and with interpretations of short-term ecological data. The following series of photos document one such example of drastic changes in the vegetation on Whale-Skate Island, French Frigate Shoals over time.



Whale-Skate Island [EK 3/66]



Whale-Skate Island [EK 7/70]



Whale-Skate Island [3/76]



Whale-Skate Island [KRN 9/90]

#### D. PLANNING

##### 1. Master Plan

The Master Plan for the Hawaiian Islands National Wildlife Refuge has been used as a guiding document for the management program on the Refuge. Many of the preferred alternatives have been implemented and others are planned as funding and manpower becomes available.

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

An intra-Service Section 7 Consultation was completed with on the sandbur control project on Laysan Island.

McDermond attended training on Introduction to Federal Projects and Historic Preservation Law.

##### 5. Research and Investigations

Refuge staff coordinated and participated in numerous research projects in the Hawaiian Islands National Wildlife Refuge. Projects were conducted by a variety of agencies and personnel, including refuge staff. Tern Island, French Frigate Shoals, continued to be a year-round focal point for wildlife studies. A field camp was established on East Island, French Frigate Shoals by Service researchers from 6 May to 16 September for the purpose of green sea turtle research. National Marine Fisheries Service (NMFS) personnel were on Tern Island, French Frigate Shoals from 13 June to 20 August for the purpose of Hawaiian monk seal research.

Uninhabited refuge islands were visited this year by various refuge personnel and cooperating researchers. McDermond and Niethammer, along with Special Use Permittees from the University of Hawaii and the National Marine Fisheries Service (NMFS) flew to Midway Atoll on 7 June where they boarded the NOAA Vessel TOWNSEND CROMWELL. The field party traveled to Pearl & Hermes Reef and Lisianski for brief stops to survey nesting seabirds, Laysan finches, ants and vegetation. A NMFS field camp was set up on Lisianski at this time.

The field party stayed at Laysan from 11-25 June, conducting Laysan finch transects, nesting seabird surveys, Laysan Duck counts and vegetation and ant surveys.

Meanwhile, Rowland and cooperating entomologist John Strazanac traveled to Nihoa Island on the sport fishing vessel Golden Eagle, arriving there on 19 June. Rowland surveyed the nesting seabirds, Nihoa finches, Nihoa millerbirds, seals,

ants and vegetation while Strazanac conducted a thorough survey of the terrestrial invertebrate life.

After stopping at Nihoa, the Golden Eagle went to Laysan, picked up field personnel and returned to retrieve the Nihoa crew on 28 June. A half-day stop was made at Necker Island where McDermond conducted seabird counts and vegetative surveys.

A significant amount of time and effort was spent by Refuge staff in Honolulu and on Tern Island to provide logistical support for investigations having significant potential benefit to the Refuge resources. The following research projects were conducted or continued in 1990:

#### **Research Management Studies by Tern Island Staff**

A great frigatebird predation study was initiated during 1990 to investigate the effects of predation on nesting brown noddies. Adult and juvenile females were documented taking brown noddy chicks from the study colony. Of 619 chicks hatched within the study area, 577 were found missing and are assumed to have been taken by great frigatebirds.

A long-term albatross study plot was established on Tern Island for the purpose of following reproductive success, nest-site fidelity, mate fidelity, and natal dispersion of individually marked pairs and their chicks. A sample size of 50 Black-footed and 50 Laysan albatrosses was chosen to initiate the study. The study plot is situated on the south side of Tern and is approximately 36 square meters in area.

Basic breeding biology studies for two species of seabirds were conducted on Tern Island during 1990. The white tern study marked its second year of research, and a brown noddy study was initiated during the 1989/1990 breeding season. These studies were designed to investigate the basic breeding biological parameters on which the foundation for our current monitoring techniques for seabird populations are based.

#### **White Terns**

A wide variety of breeding characteristics were quantified in the white tern study. Niethammer found that eggs were laid during all months of the year but that the peak of activity was in the month of March. Egg dimensions were measured in 135 eggs. Hatching, fledging, and total reproductive success calculated and the stage at which nests failed recorded. Causes of failure were also assessed. Comparisons of reproductive success with a less invasive study done previously showed no differences. Forty-seven percent of pairs laid only one egg in a season but many laid more - up to

6 eggs in a year (see Table 3). Three pairs successfully produced 2 chicks in a single year. This observation has important implications for future population monitoring methods. Incubation period ranged from 33 to 41 days with a mean of 36 days (n=96). Fledging periods averaged 49 days and ranged from 38 to 66 days. Growth rates were measured for 28 chicks. Pair fidelity in 42 pairs that returned was 92.9%. A single bird known to be 5 years old bred in 1990 establishing this as the youngest age at first breeding documented for Tern Island.

**Table 3. Reproductive effort of white terns in 1989 and 1990 nesting seasons at Tern Island based upon number of chicks fledged and eggs laid.**

Reproductive Effort	Number of pairs		
	1989	1990	combined
2 chicks/2 eggs laid	1	1	2
2 chicks/3 eggs laid	-	1	1
1 chick/1 egg laid	19	21	40
1 chick/2 eggs laid	8	9	17
1 chick/3 eggs laid	8	7	15
1 chick/4 eggs laid	3	1	4
0 chicks/1 egg laid	13	13	26
0 chicks/2 eggs laid	5	7	12
0 chicks/3 eggs laid	5	7	12
0 chicks/4 eggs laid	5	2	7
0 chicks/5 eggs laid	2	1	3
0 chicks/6 eggs laid	1	0	1

Incubation shift behavior was studied from 25 February until 25 April 1990 in 13 pairs of white terns. Nests were checked around the clock at least once every 2 to 3 hours. Incubation shift length varied from 1 hour to 112 hours. Ninety-three percent of all 253 exchanges occurred between 2000 and 0800. Mean incubation lengths were almost identical between males and females.

Two reports were produced from data collected in 1990.

A study of the breeding biology and nesting phenology of white terns at Tern Island, French Frigate Shoals (Preliminary summary of 1988/1989 and 1989/1990 seasons).

Niethammer, K. and Donna O'Daniel. 1990. Observations on a white tern incubation interval study, French Frigate Shoals, Northwestern Hawaiian Islands.

### Brown Noddies

During its first year, the study documented reproductive success, mate fidelity, and nest-site fidelity for 33 breeding pairs of color-banded brown noddies. Four of 33 pairs (12%) chose new nest sites after their first nesting attempt had failed. All four pairs remained intact, despite moving as far as 100 meters from the original nesting site. Two of 33 pairs reformed, both of these with new females, but remained in their original nest sites. The original female pair members were not seen again during the 1989/1990 breeding season.

The average number of relays for 33 pairs was 2, regardless of whether or not a chick or an egg was lost previously. Five of 33 pairs (15%) relaid after successfully raising a chick to independence, and 4 of these 5 were incubated successfully to hatching. The minimum number of days for pairs to relay after losing an egg was 12 days, after losing a chick, 18 days, and after fledging a chick 167 days. Preliminary results of this study suggest that this seabird can lay more than one clutch per season after successfully raising a chick to independence and that it can relay as many as two eggs within one incubation interval period. These data suggest that the incubation interval length count is a poor monitoring technique for estimating nesting attempts and number of breeding pairs per year for those species which frequently relay eggs within the mean incubation interval length and the breeding season.

Predation on chicks by great frigatebirds weighed heavily on a pair's ability to fledge a chick. Eighty-eight percent of the chicks that hatched were believed to have been taken by great frigatebirds.

The brown noddy management study will continue during 1991 to further document breeding biology of Tern Island's population.

### HWN-2-90 Seals/Gilmartin

Although Refuge staff assisted in many aspects of this research such as censusing, tagging and resighting, the majority of the work was conducted by personnel from the National Marine Fisheries Service. Their research activities in 1990 are reported by island or atoll.

Nihoa Island: Seals were counted by Service personnel during the June 18-29 visit. The highest number of seals observed on this trip was 21, including two pups.

Necker Island: Refuge Manager McDermond made a brief survey of Necker Island on 26 June, during which he counted 22 seals, none of them pups.

French Frigate Shoals: NMFS personnel made three trips to French Frigate Shoals in 1990.

6-16 May: The primary purpose of this trip was to search for evidence of interactions between seals and longline fisheries.

13 June to 20 August: Nine atoll-wide censuses were done in which the entire atoll was counted within two consecutive days. Preliminary results show a mean beach count of 297 seals, including pups. Deaths of 22 seals were documented, including 7 stillborn pups or aborted fetuses found on Tern Island. At least 92 pups were born on eight islets and 79 of these were tagged with yellow plastic Temple Tags®. This was a 23% decline in the number of pups born compared to the 1989 season.

A total of 54 seals were weighed and measured, all of them weaned pups or juveniles. Of the pups that were measured, 11 were less than 90 cm in axillary girth. This is the size under which pup survival is questionable. Seven of these undersized pups, six females and one male, were collected and returned to Honolulu for rehabilitation. In addition to the above mentioned transfer of undersized pups, five healthy weaned female pups were transferred to Kure Atoll to augment the population there.

Marine debris that presented entanglement hazard was either collected or burned in place and weighed an estimated 1,122 pounds.

23-29 September: The purpose of this trip was to accompany a photographer and journalist from the National Geographic Society (see HWN-11-90).

Of special note at French Frigate Shoals this year was that 4 pups were born at Tern Island.

Laysan: NMFS personnel made two trips to Laysan this year. The first was 7 April to 12 August and the second, 13 October to 8 November. Seal censuses were conducted regularly throughout the visits. Personnel also regularly patrolled the island perimeter to monitor injuries of seals, to document and photograph scarred seals, to identify parturient females and to observe any mobbing incidents. Counts from 9 May to 13 June, the time period most comparable to previous years, averaged 86.6 seals, including pups. This is the lowest total at Laysan Island since the decline began in the late 1950s.

Pup production was also at its lowest point since the late 1950s, with only 17 pups born at Laysan this year, representing a 49% decrease from the 1983-89 average.

A total of four seal deaths were documented on Laysan this year. One neonate pup died in April, an adult female died as a result of mobbing wounds in May and two seals were found dead when the field party arrived. Of the 198 injuries documented, 12 were major dorsal injuries obviously resulting from mobbing incidents.

A total of 24 seals were weighed and measured, 13 of these were weaned pups and 11 were juveniles.

Although a wedge-tailed shearwater and a Laysan albatross chick were released from drift gill nets, no seals or turtles were observed entangled in marine debris. An estimated 1,870 pounds of marine debris were collected and burned.

Two types of tags were applied to seals at Laysan Island in 1990: 1) brown plastic Temple Tags®, as have been used routinely since 1981 and 2) passive implanted transponder (PIT) tags. PIT tags are 1 cm long segments of electronically encoded wire which can be injected subcutaneously. When read with a portable scanner, the tags emit a characteristic signal which is keyed to a unique tag number. Fifty-five adult male seals were tagged with both PIT and temple tags. Temple tags were also applied to 17 weaned pups, 16 adult females and three immature seals. Temporary bleach marks were applied to 149 seals.



Hawaiian Monk Seal at Laysan Island. [DKM 6/90]

Two basking green sea turtles were tagged and seven previously tagged turtles were resighted.

Lisianski: National Marine Fisheries Service personnel were on Lisianski Island from 10 June until 11 August. Beach counts averaged 86 seals, including pups of the year. A total of 17 pups were observed, but this should be considered a minimum pup-production number because the camp was held late in the season.

No deaths were observed, but 33 injuries were documented. Two seals were observed entangled in marine debris and both were able to free themselves. A total of 8,725 pounds of marine debris were collected and burned. The last cleanup of debris on Lisianski was in 1987, so this total represents an accumulation over several years.

A total of 17 weaned pups and 18 juvenile and subadult seals were tagged with green Temple Tags®.

Tags were applied to three basking turtles, one of which had massive tumors. Resightings were made of 15 previously tagged turtles

Pearl and Hermes Reef: A brief visit was made to Pearl and Hermes from 8 to 9 June. Two atoll-wide counts were conducted with a mean beach count of 45.5 seals, including pups.

No mortalities were observed, but three out of four injuries observed were scratches inflicted upon weaned pups by adult males.

A total of ten pups were observed, but due to the short duration of this visit, this number should be considered a minimum. Six of these pups were tagged with blue temple tags.

No seals were found to be entangled, although a large net was observed fouled on coral within the lagoon. This net was not removed from the lagoon, but approximately 1,370 pounds of netting and other debris was collected and burned.

#### HWN-2-90 Green Sea Turtle Studies

During 1990, Service and NMFS personnel continued cooperative turtle research efforts concentrated on French Frigate Shoals, the major Hawaiian green sea turtle nesting area. Censusing and tagging were also conducted on other islands and atolls in the NWHI by NMFS. In addition, green sea turtle eggs and hatchlings were collected as part of a mitochondrial DNA study to determine if females return to their natal site to nest.

### French Frigate Shoals

The general objectives of this multi-year study are to monitor nesting populations, nesting and hatching phenologies, hatching success, and avian predation of turtle hatchlings. Data gathered will be used to refine input parameters for a population model that will streamline our ability to monitor populations using a sampling technique.

Tern Island: A major consideration in conducting turtle research on Tern Island is related to the condition of the seawall. The Tern Island seawall will need to be replaced, removed, or left to continue rusting away. Information on green turtle use of Tern Island (nesting and hatching phenologies, location of nests, numbers of turtles nesting on Tern Island, numbers of hatchlings produced, etc.) will be an important consideration in making a decision on the fate of the seawall.

On Tern Island, Refuge personnel monitored turtle nesting activity from 25 April through 17 December. Each morning Tern Island beaches were patrolled and any nesting activity (new nests or hatchling emergences) was recorded. While females were coming ashore to nest, an additional beach patrol was conducted at about 2100 hrs. The objective of this patrol was to identify any nesting females encountered.

Hatchling emergence was monitored by observing each nest site starting about 50 days after the eggs were laid. If a nest did not hatch within 100 days, the nest was excavated and the contents analyzed. (Throughout several years of study, extremes in incubation length have been 53 and 97 days.)



Ken Niethammer records contents of excavated turtle nest. [DKM 9/87]

Four days after hatchling emergence, all nests were excavated to determine clutch size and hatching success. Hatching success parameters were the number of addled/infertile eggs, dead embryos (1/4, 1/2, and 3/4 developed), dead fully developed hatchlings, live hatchlings trapped in the nest, and hatchlings that successfully emerged on their own (based upon the number of hatched egg shells in the nest).

At Tern Island, green sea turtles nested between 9 May and 25 September and hatchlings emerged between 13 July and 17 December. Visits to other islets showed that the nesting activity on Tern Island was representative of atoll-wide nesting activity. In 1990, 90 nests were located on Tern Island. All but eight of these nests were located on the south-facing shoreline. The exceptions were three nests on Shell Beach and five nests on Crab Beach. Twenty-eight female turtles were identified attempting to nest on Tern Island.

During 1990, 84 of the 90 nests produced hatchlings. The mean incubation period for 73 nests with known lay and hatchling emergence dates was 66.2 days with a range of 54 to 91 days.

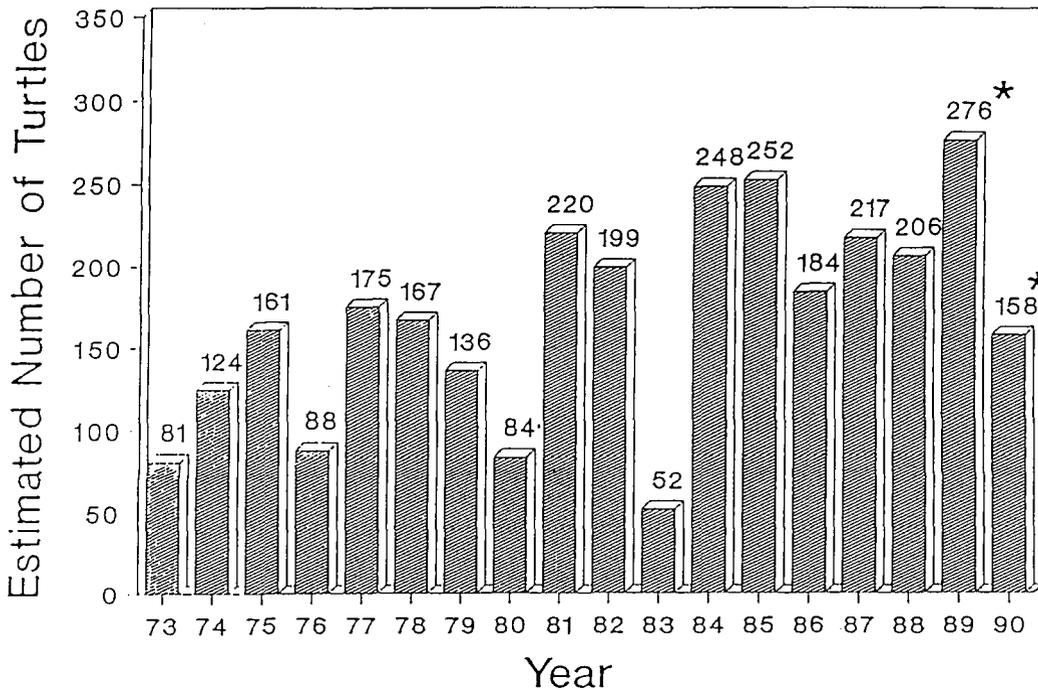
The mean clutch was 91.4 eggs with a range of 33 to 138 eggs. Individual nest success ranged from 0 to 100%. Of the 8,135 eggs, 78.2% produced viable hatchlings (defined as the number of eggs that produced hatchlings that made it out of the nest

alive). Of these, 588 hatchlings (7.2% of the total number of eggs) were found trapped (still in the nest upon excavation). Analysis showed that 15.8% of the eggs were rotten or infertile and another 6.0% of the eggs were partially developed when the embryo died.

East Island, French Frigate Shoals: Glynnis Nakai and Bob Cummins (both FWS bio-aides) monitored East Island turtle activity from 6 May through 16 September. Data collected from this monitoring will be fully analyzed by NMFS and results will be used to upgrade the statistical model used to predict atoll nesting populations. Preliminary analysis determined that 158 females were identified nesting at East Island.

**Figure 1. Green sea turtle nesting at East Island, French Frigate Shoals 1973-1990.**

Green Turtle Nesting at East Island, French Frigate Shoals, in the Northwestern Hawaiian Islands.



\*Counts Based on Saturation Tagging Throughout The Nesting Season.

HWN-03-90 Osmoregulation Studies/Paul Sievert

Paul Sievert, graduate student from the University of Pennsylvania, worked at Tern Island from 16 May to 12 July studying the constraints of maintaining water balance on seabird biology. He concentrated on three lines of inquiry.

1. A comparison of growth and blood parameters of the chicks of red-tailed tropicbirds, Laysan albatrosses, and black-footed albatrosses using shaded and unshaded nests.
2. A comparison of the reproductive success of wedge-tailed shearwaters using a variety of nest-site types.
3. Comparative morphology of the kidneys and salt glands of 9 species of seabirds.

Notable results include the observation that Laysan albatross chicks from unshaded nests weighed approximately 300 grams less than those from shaded nests. This pattern was not observed in black-footed albatrosses and he hypothesized that it might be due to differences in diet or wind regime at the nest sites between the 2 species.

red-tailed tropicbirds were compared at wholly shaded and partially shaded sites because none were found in completely sunny nests. There were no differences in blood characters related to dehydration or pre fledging masses between the 2 study groups.

Hatching success in wedge-tailed shearwaters was greatest in surface nests on which a shelter had been placed, next highest in nests under the buildings, third highest in nests in burrows and worst in open nests on the surface. Sievert attributed the poor success of open surface nests to the inability of incubating birds at those sites to maintain water balance and their resulting reduced attendance.

Thirty seabirds of 9 species were salvaged to study the relationships between kidney and salt gland morphology and diet.

Sievert also studied the foraging behavior of red-footed boobies using activity recorders that measured number of dives, date of dive, and time of dive. When the animal was recaptured to remove the recorder a food sample was collected to attempt to relate the measured behavior to food types. Fifty-seven percent of the 19 boobies studied exhibited departure times from 0530 to 0700 but 90% of all birds returned between 1700 and 2200. Male boobies had shorter foraging trips ( $x = 14.3$  hours) than females ( $x = 21.0$  hours) and brought back smaller prey items.



Red-footed Booby [CR 3/88]

HWN-06-90 Non-marine bird bone excavation/Alan Ziegler

Dr. Alan Ziegler performed archaeological, paleontological, and biological investigations at Lisianski from 10 June to 11 August 1990. His objectives were to search for remains of various land birds and mammals mentioned in historical accounts of Lisianski but no longer extant there. During his work he found bones of an unidentified duck similar to the Laysan duck (*Anas laysanensis*) and those of what probably was the Laysan Rail (*Porzana palmeri*). The duck bones may be from an endemic form now extinct on Lisianski. The presence of a bone from an apparently juvenile bird suggests that it was an endemic breeder and not just remains from a migrant. The rail bones could be from animals translocated from Laysan in 1913. Birds in this group did not survive until 1923. The absence of any passerine bones in the excavations implies that the duck was the only endemic land bird during the time represented by the presently accessible sediments.

Ziegler found no evidence of any land mammals occurring before historic times. He did find the bones of *Mus musculus* that apparently were on the island until at least 1910 and we know that the European rabbit *Oryctolagus cuniculus* was present until 1916.

Ziegler also made a variety of biological observations for the refuge including plant distribution and condition,

descriptions of terrestrial arthropods, marine invertebrates, selected reef fish, marine turtles, and breeding and migratory seabirds.

Papers generated by this research include:

Ziegler, A.C. 1990. Biological Observations on Lisianski Island, Hawaiian Islands National Wildlife Refuge, Summer 1990. Report prepared for U.S.F.W.S. Pacific Islands Office, Honolulu, Hawai'i.

Ziegler, A.C. 1990. Search for Evidence of Early Hawaiian Presence on Lisianski Island, Northwestern Hawaiian Islands, Summer 1990. Unpublished report submitted to State of Hawai'i Office of Hawaiian Affairs, Honolulu. 55 pp.

HWN-08-90 Finch Research/Sheila Conant - Terrestrial Invertebrates/John Strazanac

Dr. Sheila Conant of the University of Hawaii along with subpermittee Marie Morin visited Pearl and Hermes Reef on 8 and 9 June 1990 in order to census Laysan finches (*Telespiza cantans*) and re-sight banded finches. Conant then went on to spend 2 weeks at Laysan Island re-sighting banded birds and capturing 317 more birds (60 of them recaptures) for banding and measurement as part of a study to compare the morphology of the finches at Laysan with those at Pearl and Hermes reef. Dr. Conant also located several active finch nests and assisted the New Zealand television crew with a film about island biota.



Dr. Sheila Conant measuring a Laysan Finch.  
[DKM 6/90]

John Strazanac of the Bishop Museum Department of Entomology went to Nihoa Island as a subpermittee of Sheila Conant in order to make a synoptic collection of Arthropods, collect *Banza nihoa*- the subject of his doctoral research, collect *Cacemobius* crickets, Psyllids, *Pritchardia remota* leaves, moths and caterpillars of *Heliothus*, *Eragrostis variabilis*, and opihi. He also assisted refuge personnel (Craig Rowland) with censusing of Nihoa passerines and banding them. They banded 46 Nihoa finches (*Telespiza ultima*) and 1 Nihoa millerbird (*Acrocephalus familiaris*)

Papers resulting from this and previous year's work include:

Morin, M.P. and S. Conant. 1990. Nest substrate variation between native and introduced populations of Laysan Finches. *Wilson Bull* 102:591-604.

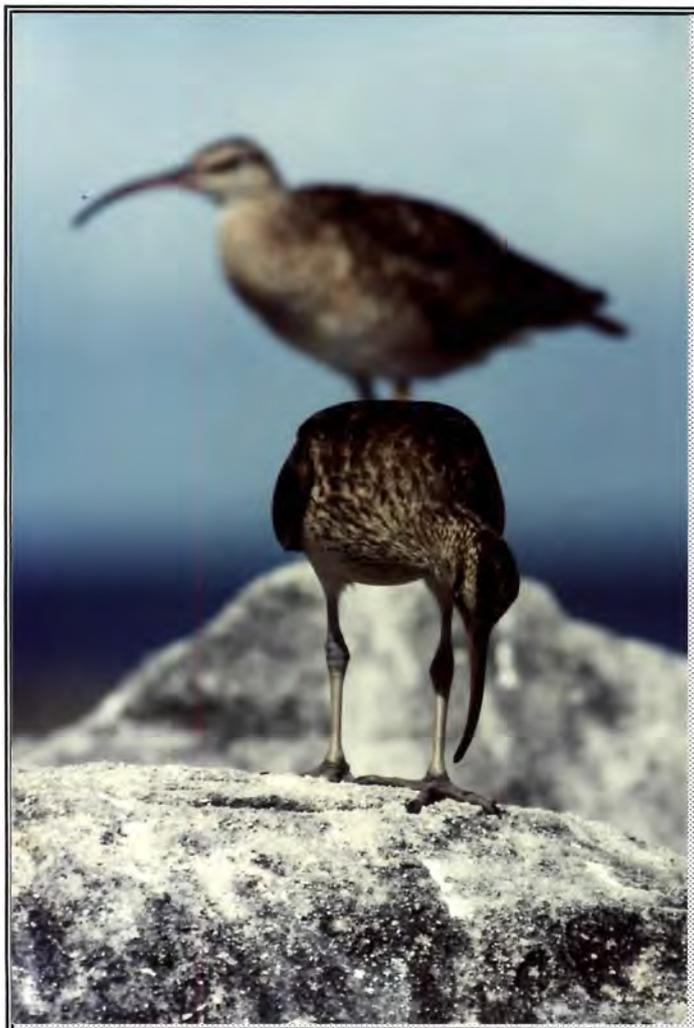
Strazanac, J.S. 1992. Report of June 1990 Nihoa Fieldwork, including new Arthropod records and W.C. Gagne collections. Report to U.S. Fish and Wildlife Service.

HWN-09-90 Coral Reproduction/Jean Kenyon

In 1990 UH graduate student Jean Kenyon continued research begun in 1989 aimed at confirming local reproduction in populations of 2 species of *Acropora* coral at French Frigate Shoals and describing the timing of their reproductive cycles. Previous work by Kenyon had shown that earlier beliefs that all *Acropora* at French Frigate Shoals were recruited from other parts of the Pacific were incorrect because she did identify signs of breeding. This season's work confirmed that *Acropora valida* is spawning at French Frigate Shoals, most likely in the first week of August. The evidence for spawning in *Acropora cytherea* was less clear but there were gametes of a size associated with reproductive maturity found. This spawning appears to have taken place before that of the *A. valida*. No colonies of either species were found during diving operations at Necker, Maro Reef, or Lisianski Island.

HWN-10-90 Bristle-thighed Curlew Research/Roland Redmond

Research on the biology of the bristle-thighed curlew (*Numenius tahitiensis*) has been carried out in the Hawaiian Islands National Wildlife Refuge since 1988. Field work in 1990 was done by Jeff Marks and assistant Milo Burcham at Midway, Lisianski, and Laysan. The visits to Midway and Lisianski were each only a day long but produced interesting band re-sightings of birds known to originate in the Yukon Delta area. On Laysan the researchers banded 66 curlews of various ages. Mark-resighting data indicated that approximately 300 curlews were using Laysan during the fall of 1990. This is about 50 fewer than the 2 previous years. Adult birds were molting between late August and mid December. Eight curlews were caught in a state of molt-induced flightlessness. Survival of marked birds since last year was 78% as compared with 83% last year. Radio tags were attached to 18 different birds in 1990 to determine the duration of flightlessness and to aid in measuring growth rates of primaries. Premature failure of the harnesses and an unpredicted mass loss and moult disruption associated with the transmitters compromised this part of the study.



Bristle-thighed curlew on Laysan  
Island. [MR 6/91]

Publications resulting from this research:

Marks, J.S. et al. 1990. Notes on Longevity and Flight-  
lessness in Bristle-thighed Curlews. *Auk* 107:779-781.

**E. ADMINISTRATION**

**1. Personnel**



Wendy Tashiro, Jerry Leinecke, Kathy Castello



Craig Rowland, Jennifer Megyesi, Ken Niethammer, Ken McDermond

- 1.\* Jerry F. LEINECKE, Project Leader, Hawaiian & Pacific Islands NWR Complex, GS-13, PFT
- 2.\* Stewart I. FEFER, Refuge Complex Manager, Remote Island Refuges, GS-12, Transferred 3/90, PFT
- 3.\* Duane K. (Ken) MCDERMOND, Refuge Manager GS-11, PFT
4. Darcy HU, Wildlife Biologist, GS-7, PFT, Resigned 7/90
- 5.\* Craig ROWLAND, Biological-Technician, GS-5, PFT
6. Kenneth R. NIETHAMMER, Asst. Refuge Mgr. (Tern Island), GS-9, PFT
7. Jennifer L. MEGYESI, Asst. Refuge Mgr. (Tern Island), GS-7, EOD 5/2/90, TFT
8. Thomas, M. MOSER, Biological Aid, GS-3, INT, Resigned 1/90
9. Glynnis L. NAKAI, Biological Aid, (Tern Island), GS-4, Terminated 12/90, TFT
11. Robert E. CUMMINS, Biological Aid, (Tern Island), GS-3, TFT
12. Richard A. BAUER, Biological Technician, GS-5, INT
- 13.\* Katherine J. CASTELO, Admin. Support Assistant, GS-7, PFT
- 14.\* Lynn, HONDONERO, Clerk Typist, GS-3, TFT
- 15.\* Wendy, TASHIRO, Purchasing Agent, GS-4, PFT
- 16.\* Dolores, HU, Clerk Typist, GS-4, Resigned 12/90, PFT

\* These staff have responsibilities for all Refuges within the Hawaiian & Pacific Islands NWR Complex and therefore only spend part of their time on Hawaiian Islands NWR. They are identified here because a narrative is not produced for the larger complex and because the Complex and the Hawaiian Islands NWR share the same office space.

S. Fefer transferred to the Regional Office in Region 5 in March.

D. McDermond assumed the duties of Refuge Complex Manager for Remote Island Refuges upon S. Fefer's departure.

C. Rowland was converted from temporary to career conditional Biological Technician GS-5 in May.

J. Megyesi was hired in May to fill the vacancy in the GS-7 Tern Island Assistant Manager position.

G. Nakai and R. Cummins were hired as temporary Biological Aids to monitor green sea turtle nesting at French Frigate Shoals during the 6 month nesting season.

D. Hu was on leave without pay to attend graduate school from 1/14 to 4/1. She resigned from the Fish and Wildlife Service on 7/9/90 to continue her education.

Table 4. Number of Employees.

FISCAL YEAR	PERMANENT FULL-TIME	PERMANENT PART-TIME	TEMPORARY	TOTAL FTE
FY90*	2.9	0	1.0	3.9
FY89	4.3	0	4.0	8.3
FY88	4.3	0	5.0	10.3
FY87	6.0	0	4.0	11.0

\*The effective decrease in personnel during the year was 1, due to the loss of the Complex Manager Position when Fefer departed. The remainder of the displayed decrease is due to a change in what positions are depicted in the table. Since clerical staff and the Complex Manager Position are shared between all Refuges they have not been displayed here. The Refuge Manager Position held by McDermond has been divided into .3 FTEs each for Hawaiian Islands, Midway Atoll, and Remote Islands for which this position has responsibility.

#### 4. Volunteer Program

Volunteers continue to play an important role in daily operations and research activities conducted on Tern Island, particularly when the refuge was short-handed while staff were on leave. Efforts are made to fully utilize the experience, training, talents, and interests of volunteers during their stays.

Volunteers Jennifer Megyesi, Sally Keefer, Scott Hall, Donna O'Daniel, Mark McDermond, Marilyn McDermond, Paul Sievert, Lyanda Haupt, Jesse Schillaci, Kerri Brust, Robert DeForest, and Andrea Roberto conducted seabird and green sea turtle studies, banded seabirds, conducted Hawaiian monk seal censuses, maintained data files, and provided assistance to the staff and visiting researchers. Volunteers also assisted with maintenance and operational tasks.

Volunteer Paul Sievert donated 20 hours per week of return for Refuge support for Ph.D. research he was conducting. This support included transportation to and from Tern Island, room and board on Tern Island, and room in our bunkhouse in Honolulu. This type of support is provided on a case by case basis, depending upon the importance of the research to the Refuge. Our experience is that these student/volunteers contribute more than their share to the Refuge.

## 5. Funding

The Hawaiian Islands National Wildlife Refuge is part of the Hawaiian/Pacific Islands National Wildlife Refuge Complex. The Complex received \$1,132,000 of 1261 funds for FY-90. Of this amount \$332,000 was base and an additional \$800,000 was added on to our budget through a special congressional appropriation. The Complex also received \$108,300 of 1262 money.

The Hawaiian Islands NWR received approximately \$438,600 in 1261 funds for operations and \$9,300 of 1262 (MMS) funds for repair of the Tern Island boat dock. The refuge did not receive any 1262 base funding.

The Refuge funded \$15,000 worth of research efforts on bristle-thighed curlews. This was an ongoing project conducted by the University of Montana Cooperative Wildlife Unit, which ran into a funding shortfall (See Section D.5).

## 6. Safety

Because of Tern Island's remote location, safety is of paramount concern. Any serious injuries or illnesses requiring Medivac face a minimum delay of 7 to 10 hours before the patient can obtain treatment in Honolulu. For this reason, safety precautions are taken seriously.

Dr. Ken Nakasone of the Honolulu Medical Group continued to act as medical advisor for Tern Island personnel and was called upon for advice as needed over the radio. Visits to his Honolulu office by Service personnel to discuss medical procedures and to evaluate the stock of prescription drugs, first aid and medical supplies were continued.

Volunteers and NMFS personnel were briefed on emergency procedures, including the use of radios in emergency situations. Practice sessions were also conducted.

Weekly radio checks were conducted with the U.S. Coast Guard. This routine procedure becomes a lifeline during emergencies. Assistance in this regard is greatly appreciated.

Emergency survival supplies, including an emergency position indicating radio beacon (EPIRB), were organized in waterproof buckets for the Boston Whalers on Tern Island. Buckets with tools, extra parts and other repair supplies were also assembled for each boat.

Personnel visiting uninhabited refuge islands, attended first aid, CPR and remote location medical training. The latter was provided free of charge by Dr. Cedric Yoshimoto.

Emergency position indicating radio beacons (EPIRBs) were carried for emergency use on expeditions to remote islands. If other means of communication fail, these can be used to summon the Coast Guard via satellite.

Refuge staff who travel to Tern Island aboard contract aircraft received water survival training sponsored by the Office of Aircraft Services.

#### 7. Technical Assistance

Refuge staff provided a variety of technical assistance to other government agencies, institutions, and individuals.

Technical assistance was provided to fishing vessels by relaying messages to Honolulu offices or to the U.S. Coast Guard. Tern Island personnel assisted with the medical evacuation of a crewman with an injured back from the lobster boat ALEUTIAN SPRAY. The crewman was picked up on 19 April and on 20 April the vessel owner paid our aircraft contractor to fly to Tern Island, pickup the crewman, and return him to Honolulu.

Assistance was provided to the U.S. Department of Agriculture's Animal Damage Control (ADC) office. This assistance was related to ADC's efforts to prevent nesting of Laysan albatross at airfields throughout Hawaii. Assistance was provided relating to biological expertise with the species.

Refuge staff provided assistance with State of Hawaii waterbird counts twice during the year.

Sea Life Park, a marine wildlife park, requested continuing assistance with establishment and maintenance of a free-flying seabird exhibit. The Refuge had been active in this endeavor for several previous years. This mainly took the form of collecting chicks of various seabird species from the Refuge and providing them to the park for raising. Although the park had some previous success with this program, there were clear problems with continuing. The park's records were very poor and therefore did not show how successful the program had been, even though birds, mainly masked boobies and great frigatebirds, had been supplied for several years. There was some evidence that once birds fledged that they were being killed by cars on the nearby highway.

It was decided that collection of healthy birds from the Refuge for this program was not justifiable. It was recommended that the park use the myriad of sick and injured birds that become available to educate the public regarding

marine and seabird conservation issues. The park was very unhappy with our decision on this issue.

McDermond assisted Kaneohe Marine Corps Air Station resource managers with development of a plan for management of fire in the combination red-footed booby colony - small arms firing range. There's nothing like a clear conflict of land use!

The Refuge coordinated a trip to Palmyra Atoll with the U.S. Coast Guard for Dr. Roland Redmond. Dr. Redmond has been studying bristle-thighed curlews in their wintering range and was interested in obtaining information from this seldom accessible atoll.

McDermond continued to participate as a member of the National Marine Fisheries Service's Honolulu Laboratory Captive Monk Seal Maintenance and Research Review Committee. McDermond is the only independent member of this committee which is otherwise made up of NMFS staff, holding facility staff, and NMFS volunteer veterinarians. His role is to conduct inspections of holding facilities and also participate in all meetings of the committee. This committee is especially important to look after the interests of the Refuge by insuring that seals that will be released into the Refuge are kept quarantined and as healthy as possible before being released back to the wild. To this end the committee has developed a set of captive care guidelines.

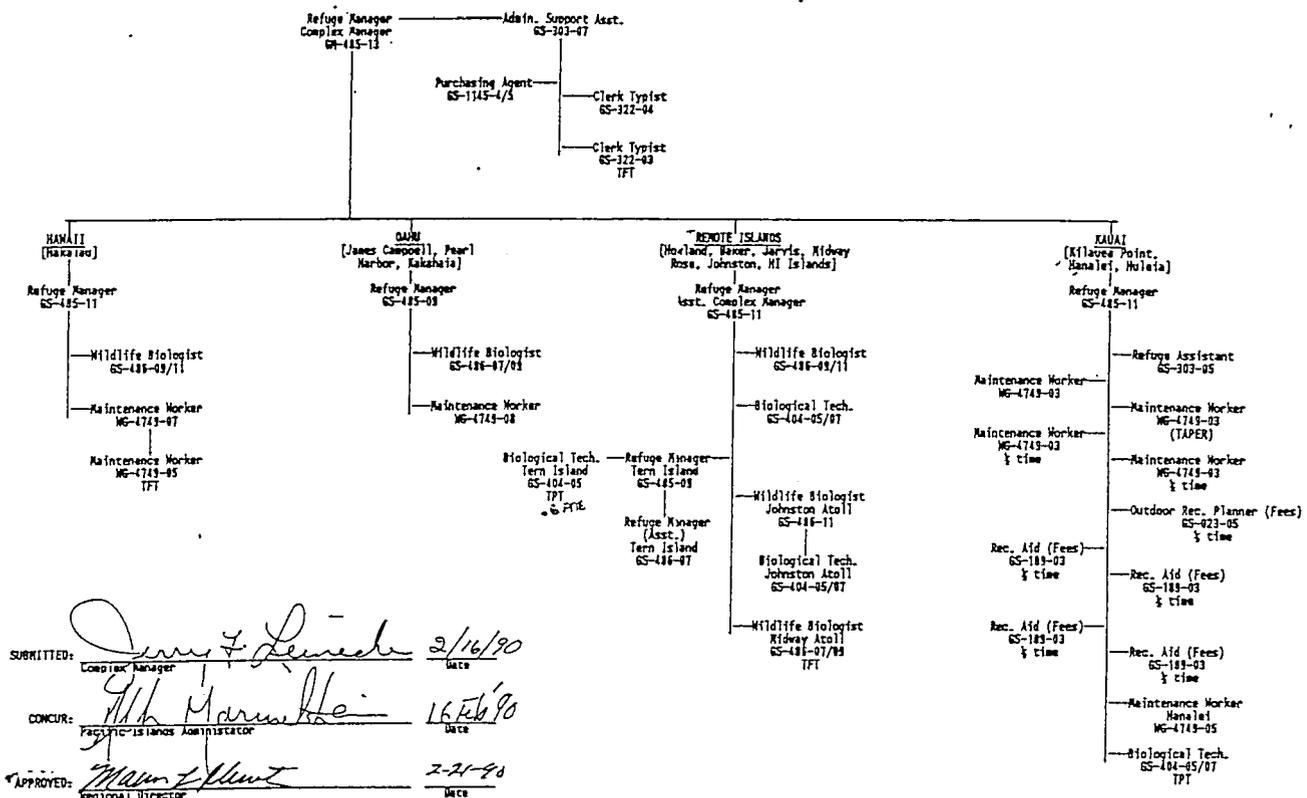
Refuge staff receive numerous requests for assistance related to our expertise in the biology and management of Pacific seabirds.

## **8. Other Items**

On February 21, 1990 the Regional Director approved a revised organization for the Hawaiian and Pacific Islands NWR Complex. The effect of this revision was to organize the Complex around geography. Four sub-complexes were created under the supervision of Refuge Managers who reported to an overall Project Leader (See Figure 2). The four sub-complexes included refuges on 1) the island of Hawaii, 2) Oahu and Molokai, 3) Kauai, and 4) Remote Islands. The Hawaiian Islands NWR came under the Remote Islands Refuge Complex and was supervised by a manager who had responsibility for Midway Atoll NWR, Johnston Atoll NWR, Howland Island NWR, Baker Island NWR, Jarvis Island NWR, and Rose Atoll NWR.

It soon became clear that the Remote Island Refuge Complex was sorely understaffed. In December plans had been developed to increase the staff and a position description had been submitted to create a Refuge Operations Specialist position.

Figure 2. Hawaiian and Pacific Islands NWR Complex Organization Chart.



## F. HABITAT MANAGEMENT

### 2. Wetlands

The Laysan lagoon or lake is the only wetland on the Refuge. The hyper-saline lake supports the endangered endemic Laysan duck and substantial populations of migratory shorebirds. During 1990, studies of the lake were limited to Laysan duck surveys (Sec.G.2).



Laysan lagoon from the north. [DKM 6/88]

### 6. Other Habitats

#### Oceanic Islands

Refuge emergent lands total approximately 1,740 acres. Nihoa and Necker Islands, Gardner Pinnacles, and La Perouse Pinnacle at French Frigate Shoals are the cores of old volcanic cones. Sheer cliffs of basalt and the absence of beaches are typical of these islands. Laysan and Lisianski Islands are low, flat sand islands surrounded by submerged fringing coral reefs. Maro Reef has only a couple of small coral heads protruding a few feet above the surface of the ocean.



Nihoa Island

Habitat management objectives mainly relate to monitoring islands for the presence or absence of native and alien species of plants. Remote islands are especially sensitive to the invasion of alien species and native plants are oftentimes present in only small populations.

Since Tern Island is the only full time staffed island in the Refuge, monitoring of other islands is accomplished through yearly visits, and through aerial photography. Refuge staff were able to visit each island except Gardner Pinnacles during the year. The visit to Lisianski Island did not allow extensive surveys. Refuge staff conducted aerial photography of all islands from Nihoa to Midway Atoll.

Marine debris that poses a fish or wildlife entrapment or entanglement hazard is burned or collected from the beaches of all refuge islands by refuge staff and cooperators. Specific habitat conditions and management activities are summarized below by island.



Debris on shoreline of Lisianski Island. [DKM 6/90]

**Nihoa Island:** During the annual visit to the uninhabited refuge island, New Zealand spinach (*Tetragonia tetragonioides*) was observed growing in the lower portion of Devil's Slide on the Island of Nihoa. This plant, which is a tenacious pest species on the Farallon Islands, has not been seen on Nihoa since the Tanager Expedition of 1924. Efforts will be made to monitor the distribution of this plant.



Field camp on Nihoa Island. [CR 6/90]

**Tern Island:** Sooty terns continued to nest in great numbers on Tern Island, and measures to minimize bird strikes by aircraft were enforced prior to the nesting season. This included removal of vegetation from the east and west ends of the runway and removal of sooty tern eggs on the runway.



Tern Island [DKM 2/90]

The degradation of the seawall continued during 1990. The major breach which occurred in 1989, located on the north-west corner of the island, continued to erode. Tern Island staff used materials on hand to fashion a patch over the affected area. They also pumped several hundred gallons of old diesel fuel from the tank into 55 gallon barrels.



Breach in seawall at northwest corner of Tern Island.  
[DKM 2/90]

Furthermore, the integrity of the seawall on the entire north side continued to deteriorate during 1990. At high tide, water is able to pass through the crumbling seawall and form large pools on the other side. The weight of water against the inside of the wall causes it to bow out and collapse into the ocean, creating further risk of entrapment to seals, birds and turtles. During 1990, 1 seal and 5 turtles became trapped behind the dilapidated north seawall. All animals were removed from behind the wall unharmed.



Degraded seawall on the north side of Tern Island.  
[10/89 CR]

The Refuge obtained \$95,000 from the regional office during 1990 for the purpose of obtaining an engineering study on the options for rehabilitating the Tern Island shoreline. The majority of this money was obligated to a contract with the Army Corps of Engineers (Corps) for completion of the study and environmental assessment. A regional office survey team traveled to Tern Island in September to complete topographic and hydrographic surveys of Tern Island and near shore submerged lands. The Corps had not initiated field work by the end of the year.

On Tern Island, all marine debris (hazardous or not), is collected from the beaches and cataloged as part of a study to quantify various types of debris.

**Laysan Island:** Laysan Island had been modified extensively by human activity during the latter 19th and beginning of the 20th century. Guano mining and devegetation by feral herbivores caused extensive sand and soil shift, changing island topography and reducing the lake depth considerably. In 1980 Service personnel observed that an area of vegetation on the central eastern portion of Laysan Island had been covered by drifting sand. During this and subsequent trips, observers noted that sand was beginning to encroach on the boundary of Laysan's lake and that the freshwater seeps on the eastern portion of the lake were beginning to fill with sand.

Also, due to the drifting sand the dune height in this area had decreased. The decrease in dune height could increase the likelihood of flooding of the lake due to the storm surge. If the ocean flooded the lake, major changes in the lake's ecology could occur. In an attempt to arrest the drifting sand and allow the vegetation to reestablish in the area in hopes of preserving the freshwater seeps for the Laysan duck, a drift fence was constructed in a number of phases, between 1984 and 1988.

During the June trip to Laysan, photos were taken at stations established in 1988. An aerial photo flight was conducted in September of 1990. From this data, it was evident that there was increased vegetation cover in the area of the original blowout. However, the larger area encompassed by the drift fence had a loss of vegetation cover, primarily in the southern portion. This loss of vegetation could possibly be a result of the wind being redirected around the south end of the fence. Whether this vegetation loss would have occurred without the fence is unknown.



Aerial photo of drift fenced area on Laysan Island.  
[CR 9/90]

Special Use Permittee Jeff Marks, who was present on Laysan for most of the winter, reported storm waves which brought sea water into the lake on the southeast side of the island. This was not in the same location as the blowout. Storms during

this time period also deposited large amounts of sand between the drift fence and the lake.

A priority objective of the 1990 trip to Laysan Island by Refuge staff was to determine the distribution of the alien species *Cenchrus echinatus*. McDermond and Niethammer surveyed the island as extensively as possible while annotating infested areas on a map. In addition, a transect sampling system was established in the large area infested in the western portion of the island. These transects were established in a manner that would allow future monitoring of the species' status in this area.



A beautiful scene at the Laysan field camp, marred by the extensive cover of the alien species *Cenchrus echinatus*. [DKM 6/90]

McDermond and Niethammer also searched for and documented the status of the rare endemic plant *Mariscus pennatifolius bryanii*. Three plants were found at the southeast corner of the island near the lake. This is the only location they have been documented in recent history. Plants were mapped, phenology described, and the area was marked with four PVC stakes in a 20m by 20m square. Seeds were collected and returned to Honolulu. These were given to Service botanist Derral Herbst, who gave them to the National Tropical Botanic Garden on Kauai.



The last known location of *Mariscus pennatifolius bryanii* in the world on Laysan Island. [DKM 7/90]

### Near Shore Marine Environment

The Fish and Wildlife Service considers 252,700 acres of submerged land to be within the Refuge. These submerged lands encompass the near shore marine environments adjacent to each main group of Refuge Islands.

Very little monitoring of the near shore environment is conducted by the Refuge. Research by cooperating agencies and others is encouraged. In this way we hope to gain additional information on marine resources.

#### 10. Pest Control

The three components of pest control in the Hawaiian Islands National Wildlife Refuge are prevention, monitoring and control. Preventing the introduction of alien species requires strict regulation of items transported to Refuge islands and educating staff members and cooperating researchers in field camp packing protocol. This protocol calls for freezing or fumigating as many items as possible and insuring that supplies are packed in clean containers, free of insects and seeds.

During 1990, pest control primarily involved implementing procedures to prevent the introductions of exotic organisms. Also during visits to the refuge, the status of alien organisms was monitored (See above).

The following pest control activities took place on Refuge islands in 1990:

On Tern Island, eradication of the noxious weed sandbur (*Cenchrus echinatus*) continued. The island was regularly patrolled throughout the year, and all sprouts were pulled. Seed heads were disposed of through incineration to prevent germination.

Removal of sandbur and bristly foxtail (*Setaria verticillata*) from East Island was begun in mid-summer. Bristly foxtail, another noxious weed, is found only on East Island at French Frigate Shoals.

An increase in Tern Island's ant population was observed during 1989. Many birds were found covered with ants, and brown noddy and red-tailed tropicbird chicks were found dead or dying and covered with ants. Ground nesting species were observed deserting their nests where ants swarmed over the birds and the chicks or eggs. Samples of ants were collected from Tern, Whale-Skate, and East Islands at French Frigate Shoals and all other islands of the refuge. After identifying

the species found, plans will be developed to see if eradication is possible or warranted.

During the June trip to Laysan, McDermond and Niethammer established plots to test three methods for controlling sandbur (*Cenchrus echinatus*). Plots were established just south of the Refuge sign to test 1) tarping, 2) pulling, and 3) herbicide. An additional set of spray and pull plots was established just behind tent row. National Marine Fisheries Service researchers on the island were to follow up on monitoring these plots after Refuge staff departed.



Niethammer establishes test plots for control of sandbur on Laysan Island. [DKM 7/90]

A Pesticide Use Proposal was issued to the Refuge for use of Roundup on Laysan Island and French Frigate Shoals

## G. WILDLIFE

### 2. Endangered and/or Threatened Species

The islands within the Hawaiian Islands National Wildlife Refuge 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 the Laysan finch, monk seal, and green sea turtle was described in a preceding research section. 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 measures are taken:

- 1) Entry onto the refuge is prohibited to all but persons with Special Use Permits. Permits are generally given only to activities which are likely to directly benefit the resources or improve management practices, so many requests are turned down.
- 2) All Special Use Permits include provisions to prevent disturbance to endangered species and degradation of endangered species habitat.
- 3) Movement of all personnel on all refuge islands 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 affect endangered or threatened species are also submitted to Section 7 (Endangered Species Act) consultation with the Service and the National Marine Fisheries Service.

The Hawaiian Islands National Wildlife Refuge has only one resident waterfowl species, the Laysan Duck. It is an endemic and endangered species, inhabiting the hypersaline lake on Laysan Island. These ducks were counted 9 times between 15 June and 20 November 1990 using a standard census. Counts ranged between a low of 72 in June (number affected by breeding and molt) and 375 (18 September 1990). Only 3 ducklings were sighted on each of the 2 June counts.

Laysan finches were censused at Laysan Island on 1-2 October 1990 by Jeff Marks and Milo Burcham. The population estimate from this count was  $15,432 \pm 2635$ . This estimate is higher than many previous counts but the time of year the count was done is also different from previous years.



Color banded Laysan finch at Laysan Island. [DKM 6/90]

The small introduced population of Laysan finches at Pearl and Hermes Reef was surveyed by McDermond, Conant, and Morin on 8 and 9 June 1990.

**Table 5. Laysan finch populations on Pearl & Hermes Reef in 1990.**

ISLAND	POPULATION ESTIMATE
Southeast	94 birds
North	41 birds
Grass	18 birds
Seal-Kittery	29 birds
<b>TOTAL ATOLL ESTIMATE</b>	<b>182 BIRDS</b>

Numbers of Nihoa finches and Nihoa millerbirds were estimated during standard counts on 23 to 28 June 1990 done by Rowland. An estimate of 1708  $\pm$ 580 finches for 1990 is substantially lower than the last count in 1988 of 3355  $\pm$ 1232 finches. The millerbird was extremely low with only 1 animal being seen on the 54 transects for an estimate of 31  $\pm$ 63 birds. Four recently fledged millerbirds were observed in the Miller Plateau area indicating that some breeding was occurring.

### 3. Waterfowl

The general lack of suitable habitat for waterfowl and the distance from major waterfowl migratory routes accounts for the rarity of this group within the refuge. The only resident waterfowl species is the endemic and endangered Laysan duck which inhabits the hypersaline lake on Laysan Island. Studies of this species are described in the Endangered and/or Threatened Species section (section G.2) above. Migrants and vagrants observed at Laysan Island included Northern Shovelers, American Wigeons, Northern Pintails, Lesser Scaup, Canvasbacks, Eurasian Wigeons, Buffleheads, and Green-winged Teal. Visitors to French Frigate Shoals included a Brant, White-fronted Geese, Northern Pintails, and Green-winged Teal.

### 4. Marsh and Water birds

Hawaiian Islands National Wildlife Refuge also lacks habitat for most marsh and water birds. The only members of this category using the refuge this year were an American Coot at Laysan Island and 2 Cattle Egrets at French Frigate Shoals.

### 5. Shorebirds and Seabirds

Having a resident staff at French Frigate Shoals allows us to conduct year-round monitoring of seabird and shorebird populations at that atoll. At the other islands in the refuge our visits are less frequent and we can measure populations only during brief field expeditions. Intensive monitoring at French Frigate Shoals helps us interpret the results of short term observations at the other parts of the refuge. Throughout this section birds may be referred to by their 4-letter code on tables and figures. See Table 6 for translation to common and scientific names.

**Table 6. Four letter codes for avian species used in narrative.**

BFAL	Black-footed Albatross	<i>Diomedea nigripes</i>
LAAL	Laysan Albatross	<i>Diomedea immutabilis</i>
WTSH	Wedge-tailed Shearwater	<i>Puffinus pacificus</i>
CHSH	Christmas Shearwater	<i>Puffinus nativitatis</i>
BOPE	Bonin Petrel	<i>Pterodroma hypoleuca</i>
BUPE	Bulwer's Petrel	<i>Bulweria bulwerii</i>
SOOP	Sooty Storm-petrel	<i>Oceanodroma tristrami</i>
RTTR	Red-tailed Tropicbird	<i>Phaethon rubricauda</i>
MABO	Masked Booby	<i>Sula dactylatra</i>
BRBO	Brown Booby	<i>Sula leucogaster</i>
RFBO	Red-footed Booby	<i>Sula</i>
GRFR	Great Frigatebird	<i>Fregata minor</i>
SOTE	Sooty Tern	<i>Sterna fuscata</i>
GRAT	Gray-backed Tern	<i>Sterna lunata</i>
BRNO	Brown Noddy	<i>Anous stolidus</i>
BLNO	Black Noddy	<i>Anous minutus</i>
BGNO	Blue-gray Noddy	<i>Procelsterna cerulea</i>
WHTE	White Tern	<i>Gygis alba</i>
BTCU	Bristle-thighed Curlew	<i>Numenius tahitiensis</i>
GOPL	Lesser Golden Plover	<i>Pluvialis dominical</i>
WATA	Wandering Tattler	<i>Heteroscelus incanus</i>
SAND	Sanderling	<i>Calidris alba</i>
RUTU	Ruddy Turnstone	<i>Arenaria interpres</i>

Table 7 shows an estimate of the minimum number of breeding birds at French Frigate Shoals by island and gives an idea of the relative importance of each of the islands as a breeding site for any particular species. For some species such as Christmas shearwaters, black noddies, sooty terns, red-footed boobies, red-tailed tropicbirds, and great frigatebirds the count at Tern represents almost the total population. These values are the highest number of nests encountered at one time (visits at intervals approximately one month in length were made to the outer islands throughout the breeding season). La Perouse Pinnacle is not included in these counts because of the difficulty in obtaining accurate numbers from this inaccessible rock.



Adult Laysan albatross feeding chick. [DKM 6/90]

**Table 7. Minimum number of breeding pairs of seabirds at French Frigate Shoals by Island for 1990.**

Species	Tern	Gins	Whale-skate	Trig	East	Total
Black-footed Albatross	618	206	1473	87	2118	4502
Laysan Albatross	1303	1	213	16	709	2242
Wedge-tailed Shearwater	823	0	NC	?	NC	823
Christmas Shearwater	40	0	?	0	?	40
Tristram's Storm-petrel	0	0	NC	0	2	2
Bulwer's Petrel	10	0	0	0	?	10
Red-footed Booby	888	0	7	0	0	895
Brown Booby	0	0	0	0	0	0
Masked Booby	4	21	160	11	81	277
Red-tailed Tropicbird	579	0	7	0	4	590
Great Frigatebird	482	0	0	0	0	482
Gray-backed Tern	389	0	0	0	5	394
Sooty Tern	NC	0	0	0	0	NC
Brown Noddy	1720	0	513	0	284	2517
Black Noddy	1226	0	0	0	0	1226
White Tern	51	0	0	0	0	51

? - indicates that the presence or absence of the species is not known

NC - indicates that the species is present but was not counted

Table 8 and Figure 3 show an estimate of breeding birds on Tern Island for the last decade. These estimates are a more accurate account of the total number of breeding pairs and total nesting attempts for those species which are determinate layers (those species which do not relay eggs during the breeding season, such as the Procellarids).



Laysan albatross chicks along lake shore at Laysan Island. [DKM 6/90]

**Table 8. Minimum number of breeding pairs of seabird species on Tern Island, French Frigate Shoals, 1980-1990 (based on the highest number of active nests).**

SPECIES	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Black-footed Albatross	82	96	149	193	221	292	304	448	451	516	618
Laysan Albatross	485	688	810	852	854	720	588	1032	990	1060	1303
Red-tailed Tropicbird	NC	370	307	250	337	474	519	377	499	513	579
Red-footed Booby	NC	394	341	404	605	727	691	735	932	1133	888
Masked Booby	0	0	0	0	0	0	0	1	0	1	4
Great Frigatebird	0	0	0	1	0	181	445	657	395	632	482
Bulwer's Petrel	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	10
Wedge-tailed Shearwater	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	823
Christmas Shearwater	NC	NC	NC	NC	NC	NC	NC	NC	NC	25	40
Gray-backed Tern	NC	72	98	56	48	102	193	145	345	332	389
Sooty Tern	NC	NC	24340	14700	17200	NC	41788	NC	NC	NC	NC
Brown Noddy	NC	491	511	582	736	929	810	1085	1137	1384	1720
Black Noddy	NC	275	630	439	355	832	560	605	1170	1600	1226
White Tern	15	25	NC	27	23	38	31	34	46	48	51

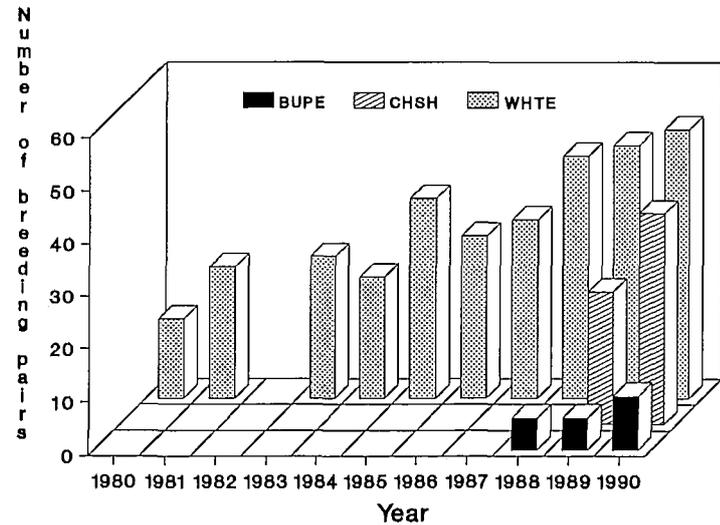
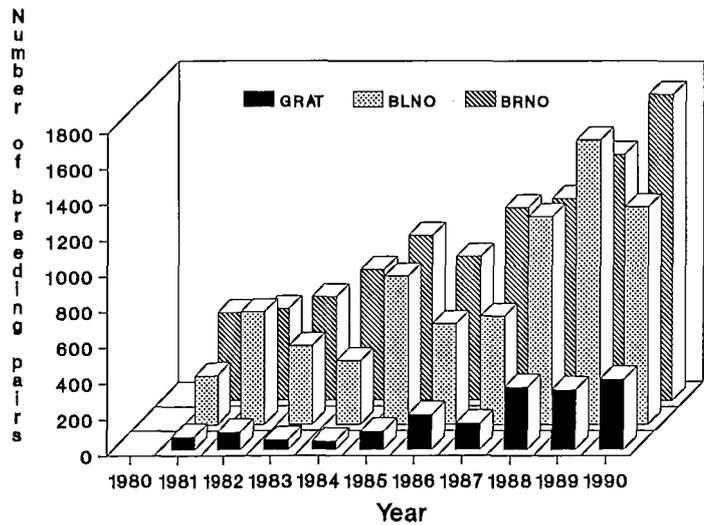
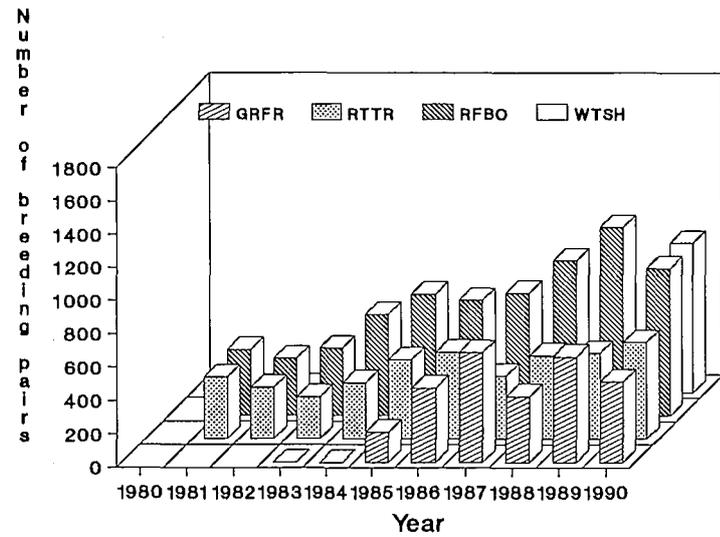
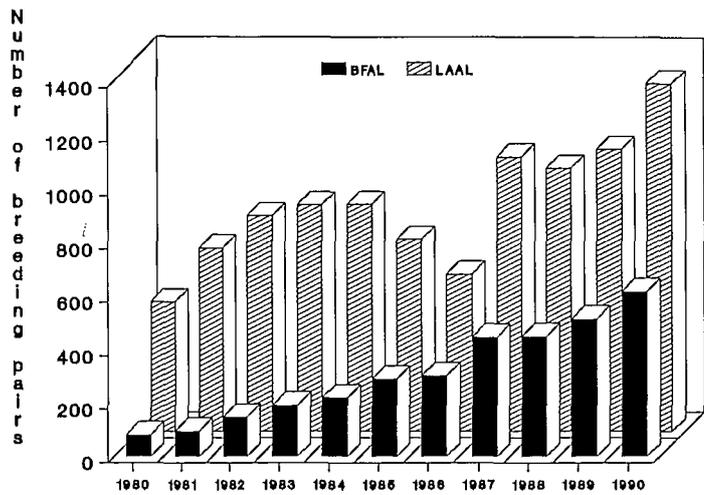


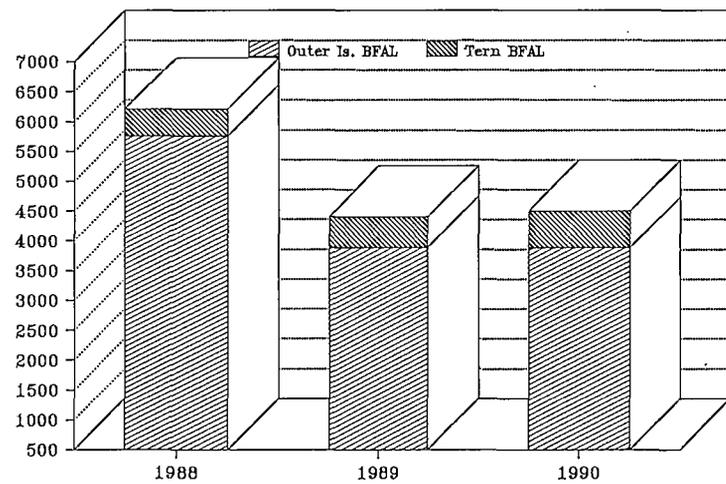
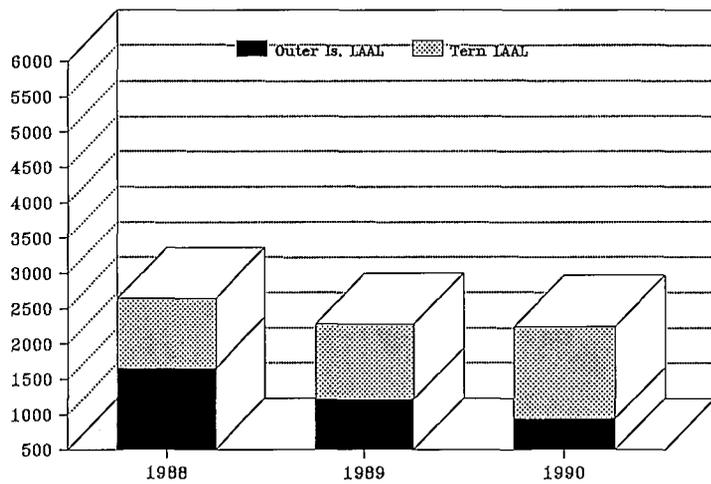
Figure 3. Minimum number of breeding pairs of seabird species on Tern Island, French Frigate Shoals, 1980-1990 (based on the highest number of active nests).

Figure 4 illustrates the importance of outer island censuses. Though the Tern Island albatross populations have increased, there appears to be an atoll-wide decline in population. All Tern Island populations have shown a steady increase since the departure of the U.S. Coast Guard in 1979. Continued routine visits to East, Trig, and Whale-Skate enable Tern Island staff to better monitor breeding populations within the atoll. Nesting birds at La Perouse Pinnacle (brown boobies, brown noddies, black noddies, gray-backed terns, white terns, and perhaps Sooty storm-petrels and Bulwer's petrels) are estimated whenever possible but the exposed position and our inability to land there make these numbers less reliable. Round, Shark and Disappearing Islands had no breeding populations during 1990, though loafing adult and immature Laysan and black-footed albatross, brown and black noddies, and masked and brown boobies were often observed.

Reproductive success was measured for black noddies, red-footed boobies, and red-tailed tropicbirds as part of a monitoring program that has been in place since 1980.

Island-wide shorebird counts were conducted throughout the year on Tern Island during 1989. A summary of the species and numbers are presented in Figure 5.

Migrants and vagrants in this category at Laysan Island included a large flock of over 40 Sharp-tailed Sandpipers in October. At French Frigate Shoals staff observed 3 sharp-tailed sandpipers, 1 common snipe, 1 semi-palmated plover, 1 ruff, and 1 bar-tailed godwit. They also saw 1 little tern, 1 glaucous-winged gull, 1 lesser frigatebird, and 1 red-billed tropicbird.



**Fig 4.** Population estimates of Laysan and black-footed albatross for French Frigate Shoals, 1988-1990. Outer island population estimates refer to those counts on East, Whaleskate, Gins, and Trig.

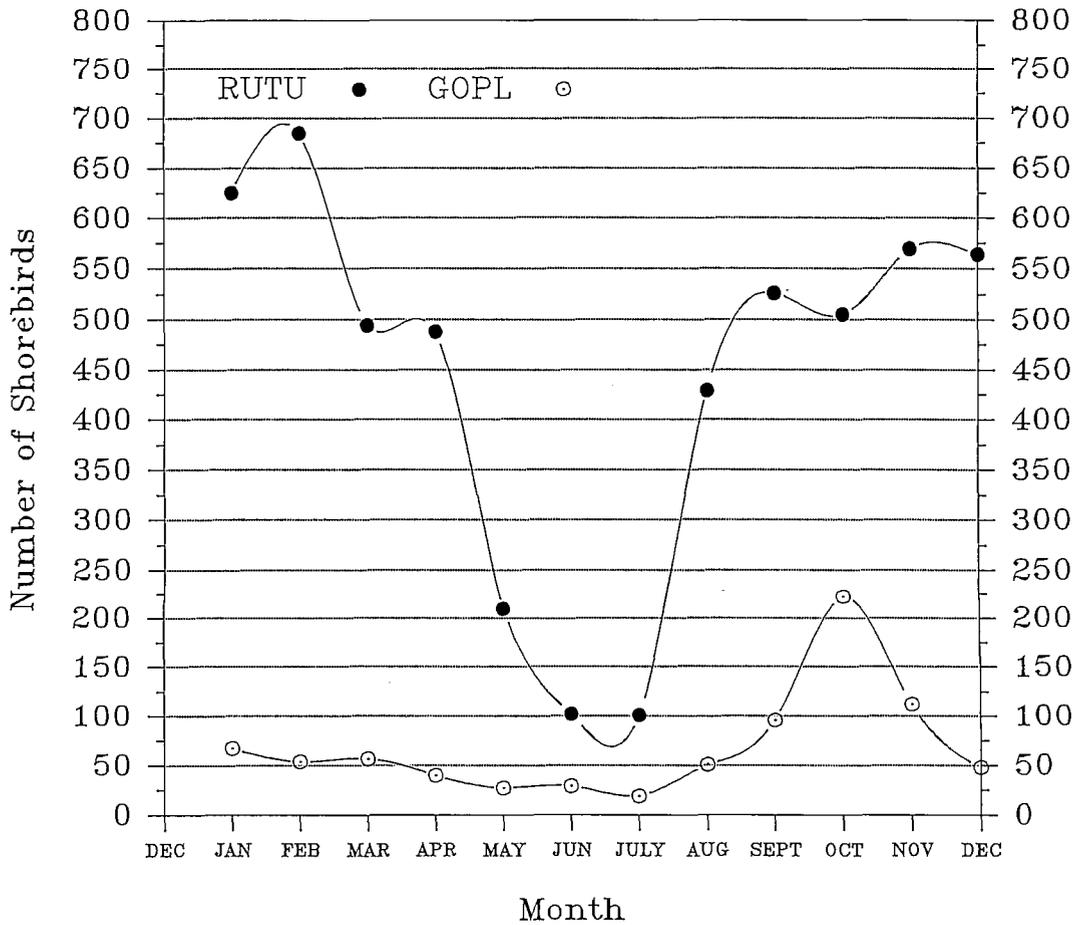
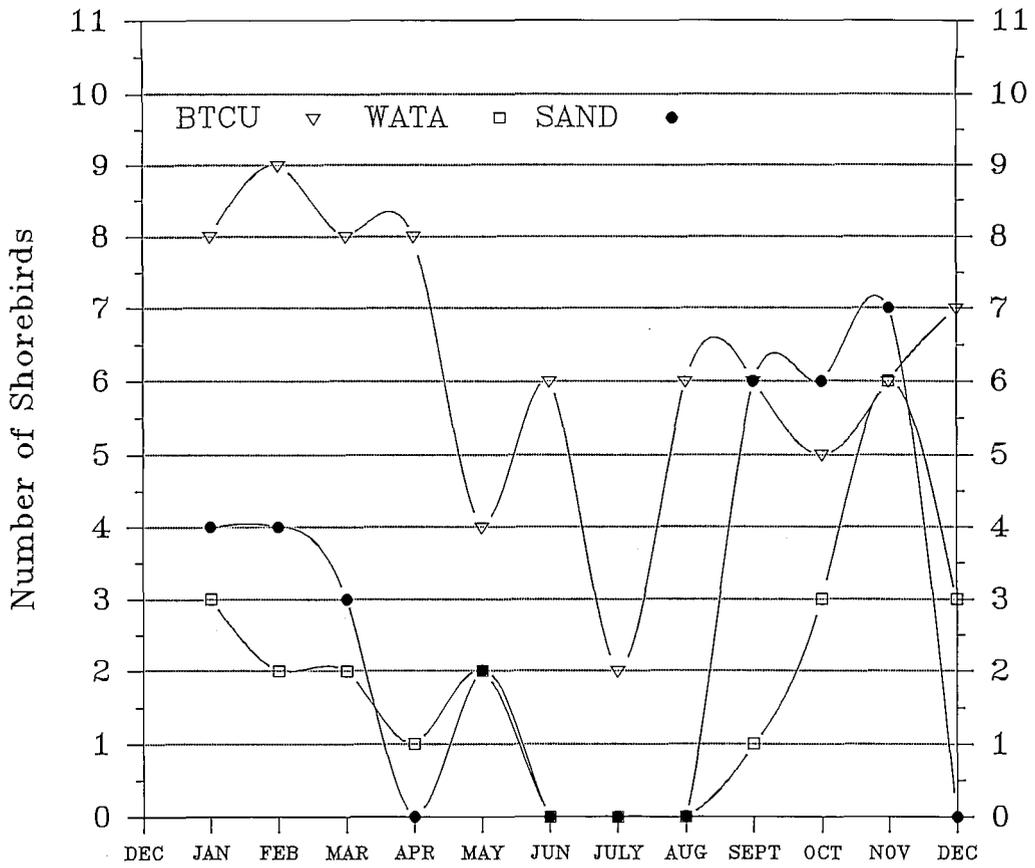


Fig. 5 Average number of shorebirds counted monthly on Tern Island, FFS., 1990

## 6. Raptors

No raptors were reported in the refuge in 1990.

## 9. Marine Mammals

John Twiss, Executive Director of the Marine Mammal Commission visited Tern Island on March 13 to view first hand the Tern Island seawall and habitat conditions for Hawaiian monk seals.

## 14. Scientific Collection

Educational institutions such as universities and other schools, conservation organizations and museums find the Hawaiian Islands National Wildlife Refuge a valuable resource for salvaged specimens of endemic and indigenous wildlife species. The refuge also makes fresh specimens available to the National Wildlife Health Center for diagnosis. Specimens salvaged in 1990 as skins, skeletons, frozen carcasses and eggs from the refuge were the following (numbers of specimens in parenthesis):

### **Birds**

Black-footed Albatross (1)  
 Laysan Albatross (1)  
 Wedge-tailed Shearwater (1)  
 Bonin Petrel (1)  
 Red-tailed Tropicbird (3)  
 Great Frigatebird (1)  
 Sooty Tern (3)  
 Brown Noddy (4)  
 Black Noddy (4)  
 White-fronted Goose (1)  
 Bristle-thighed Curlew (2)  
 Lesser Golden Plover (2)  
 Ruddy Turnstone (3)  
 Laysan Duck (1)  
 Laysan Finch (1)

### **Reptiles**

House Geckos (6)  
 Mourning Geckos (3)  
 Stump-toed Gecko (1)

### **Terrestrial Invertebrates**

Terrestrial Mollusks (310)

## 16. Marking and Banding

A variety of animals are marked, tagged, and/or banded annually on the Refuge Islands. Hawaiian monk seals are tagged as part of the monk seal research project conducted primarily by NMFS research program. Green sea turtles are tagged as part of cooperative work between the FWS and NMFS. Data on monk seal and green sea turtle tagging are presented in the discussion of these projects in the Research and Investigations section (Sec.D.5) as are the banding activities of Sheila Conant and her subpermittees on passerine birds and the bristle-thighed curlews banded under the Redmond permit.

Birds are banded as part of the refuge effort to monitor seabirds and migratory shorebirds which use Refuge islands. At French Frigate Shoals, most of our seabird banding effort is directed towards banding chicks produced on Tern Island. The goals of our seabird banding program are : 1) to provide fledging success data; 2) establish known-age populations so that we can monitor productivity and survival of age classes, age of first breeding, and other factors that relate to interpretation of reproductive parameters being monitored; and 3) to provide a base of banded birds for longevity, dispersion, and other data. Staff of this refuge coordinate the banding program throughout the Hawaii/Pacific Complex.



Glynnis Nakai prepares to band a wedge-tailed shearwater chick on Tern Island. [CR 10/90]

**Table 9. Hawaiian Islands NWR\*  
banding totals for 1990.**

SPECIES	BANDS
Black-footed Albatross	700
Laysan Albatross	1321
Bonin Petrel	10
Bulwer's Petrel	6
Wedge-tailed Shearwater	351
Christmas Shearwater	14
Red-tailed Tropicbird	407
Masked Booby	168
Red-footed Booby	329
Great Frigatebird	200
Gray-backed Tern	152
Sooty Tern	330
Blue-gray Noddy	2
Brown Noddy	380
Black Noddy	790
White Tern	120
Ruddy Turnstone	1
<b>TOTAL</b>	<b>5281</b>

\* All banding was at French Frigate Shoals in 1990.

#### H. PUBLIC USE

##### 1. GENERAL

Public use on the Hawaiian Islands National Wildlife Refuge 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 and for educational purposes, we attempt to keep the public informed by encouraging and assisting artists, journalists, researchers, 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, French Frigate Shoals).

Special Use Permits were issued for the following photographic and journalism activities in 1990:

HWN-5-90 Television New Zealand/Rod Morris

Footage was obtained at Laysan Island and French Frigate Shoals, for a natural history television series entitled Islands. The three programs in the series will examine dispersal of organisms to islands, methods of evolutionary change, and evolutionary trends in insular ecosystems. The permittee worked closely with Dr. Sheila Conant of the University of Hawaii. Dr. Conant frequently conducts passerine research on refuge islands, and worked this year under Special Use Permit HWN-8-90.

HWN-7-90 Pacific Rim Media Company/Ed Carus

A documentary video was produced on the making of the above natural history film. Video taping took place at French Frigate Shoals and Laysan as well as while under way. Mr. Carus is the owner/captain of the charter vessel used by the Television New Zealand film crew.

HWN-11-90 National Geographic Society/Ackerman & Curtsinger

A journalist and a photographer traveled to Tern Island to collect material for an article on Hawaiian monk seals and for a chapter in a book on endangered species.

**6. Interpretive Exhibits/Demonstrations**

Refuge staff routinely provided information, leaflets and brochures to various interested groups. Biological Technician Rowland presented a talk on the "Birds of the Northwestern Hawaiian Islands" to students at McKinley High School. McDermond presented a talk on the effects of marine debris on wildlife to the Sierra Club. McDermond and Rowland presented a talk on seabirds to volunteers at Kilauea Pt. NWR.

**17. Law Enforcement**

The Hawaiian Islands National Wildlife Refuge is comprised of isolated, inaccessible islands which are closed to the public. Law enforcement is not a major activity and there are no Refuge officers. Law enforcement in the refuge consists primarily of monitoring Special Use Permits, Migratory Bird Permits, and Endangered Species Permits issued to cooperators conducting studies on the refuge. In addition, refuge staff

coordinate with the Coast Guard concerning potential illegal entry inside refuge boundaries, which they monitor by irregular aircraft and vessel patrols.

Low-flying aircraft cause disturbance to wildlife populations on refuge islands. Although these low-level over-flights are not a frequent occurrence, their impact can be significant, especially to species with low population levels. Recent military over-flights in the Northwestern Hawaiian Islands, caused virtually all birds to take flight and scared monk seals into the water. When birds are scared off nests, they must leave their young unprotected and occasionally are so startled that they knock eggs and chicks completely out of the nest.

Significant disturbance of wildlife resulted on one occasion in 1990 from a helicopter overflight at French Frigate Shoals on February 25. Several islands at the atoll were flown over, causing many birds to alight.

Low-flying aircraft over these refuge islands usually, but not always, belong to the military. A means of informing military personnel about the sensitive nature and protected status of these islands would be very beneficial. This is especially true in light of the rapid turnover of military personnel and the lack of long-term guidelines regarding this subject.

Nearly all law enforcement activities within the refuge occur at French Frigate Shoals and pertain to fishing vessels. With a permanent field station at Tern Island, the Shoals can be closely monitored. Many vessels pass near the Shoals, or rendezvous with other vessels in this area, as French Frigate Shoals is a half-way point for boats operating out of Honolulu.

All fishing boats observed from Tern Island are contacted by radio and are informed of refuge boundaries. This method has proven effective in establishing good working relationships with the captains. Additionally, all vessels which receive fishing permits for the Northwestern Hawaiian Islands are mailed information on the Refuge boundaries.

There was no visible sign of trespass on Refuge islands visited during the year. However, during the annual expedition to the Refuge, a sailboat arrived at Nihoa. The occupants had the intention of landing on the island, thinking it was a national park. The two men on the boat were instructed by Refuge Manager McDermond that landing was not allowed. This coincidental encounter raised concerns about the frequency of unauthorized landings on Refuge islands.

priority. Perhaps a time-lapse camera could be employed to photograph likely landing areas, once or twice per day in an attempt to detect trespassing events.

## I. EQUIPMENT, FACILITIES, AND LOGISTICS

### 2. Rehabilitation

On Tern Island, rehabilitation of equipment and structures is an ongoing effort where low elevation (6 feet above sea level), small area, and constant winds carrying salt spray result in much corrosion.



Facilities at Tern Island. [CR 7/89]

### 3. Major Maintenance

Regular maintenance activities at Tern island included scheduled servicing of the photovoltaic system, diesel and gasoline generators, outboard engines, tractor, ATV, boat hoist, Boston Whalers, Zodiac, freshwater system, salt water system, sewage system, boat dock, buildings, refrigeration systems and the runway.

#### **4. Equipment Utilization and Replacement**

Tern Island's photovoltaic power system performed faultlessly throughout 1990. Diesel generators were used for the boat hoist, cistern and saltwater pumps, and the washing machine. Originally the photovoltaic system was designed to provide 3 days of electricity without input from the sun; however, present power consumption exceeds initial design specifications of the system. The photovoltaic battery has to be recharged with a diesel generator after 24 hours without adequate sun.

The 70 HP outboard on the orange Boston Whaler at Tern Island was replaced with our new backup motor because it continued to be unreliable. The new motor runs beautifully and the old motor was sent back to Honolulu for repairs. The 40HP motor used on the Zodiac was returned to Honolulu for repair. All other outboards ran smoothly with only minor repairs needed.

The Tern Island Non-directional Beacon system was decommissioned due to revisions to the Pearl Pacific Air contract. This allowed us to dismantle a long wire antenna system which had been a hazard for seabirds and a constant maintenance headache.

Tern Island developed protocols for waste disposal with a strong recycling component and source reduction.

Field camp equipment for short-term visits to refuge islands was purchased and used as needed. This consisted of routine camping gear as well as scientific equipment.

A 1978 Dodge van was transferred to us from the Law Enforcement Division. It will be parked at Kapahulu and used when we have vehicle shortages.

#### **5. Communications Systems**

Tern Island is a remote field station with the nearest assistance 500 miles away in Honolulu, which makes radio communication vital to the operation of the refuge. Scheduled radio contact is made with Honolulu and Tern Island provides radio checks with seasonal field camps at Laysan and Lisianski Islands and Pearl and Hermes Reef. Information is then relayed to Honolulu. In addition to two, redundant high-frequency, single-side band radios, a VHF radio provides short-range communication between refuge staff and fishing vessels. The repeater system installed on East Island continues to facilitate intra-atoll communications.

## 8. Logistics

Because of the remoteness of the Refuge, simply visiting the islands requires complicated logistics. Significant staff time and budget are spent on this activity. Whereas most Refuges take it for granted that they will visit and conduct management activities on the lands under their jurisdiction, Hawaiian Islands NWR staff have to carefully consider the logistics and costs of each visit.

The Kapahulu bunkhouse/warehouse complex continued to be a valuable asset to the Refuge. The bunkhouse was utilized over 70% of the year by staff, volunteers, and cooperating researchers. This has saved thousands of dollars that would be required for hotels.

Numerous hours are spent annually providing logistical support for the Tern Island field station. This support includes procuring equipment, supplies and food, coordinating volunteers and field personnel, arranging transportation, preparing items for transport (water-proofing), and loading items onto ships or planes.

Pearl Pacific Enterprises continued in its second year of a three year renewable contract for flight services. A total of 23 flights were used to support operations at Tern Island. One flight each was paid for by the following agencies: National Weather Service, National Geographic Society, Marine Mammal Fund and Marine Mammal Commission. Captain Bob Justman completed his 200th round trip flight to Tern Island on March 13th.



Contract aircraft refuels at Tern Island in preparation for aerial photography mission.  
[JLM 10/90]

Three vessel deliveries were required to support Tern Island. The ships used were the NOAA Ship TOWNSEND CROMWELL and a chartered sport-fishing boat, the GOLDEN EAGLE.

The annual trip to Refuge islands was conducted in June by staff McDermond, Niethammer, and Rowland and cooperators Dr. Sheila Conant and John Strazanac. McDermond, Niethammer, and Conant flew to Midway Island aboard an Air Force C141. They then boarded the NOAA ship TOWNSEND CROMWELL which transported them to Pearl & Hermes Reef, Lisianski Island and Laysan. In the meantime a chartered vessel the GOLDEN EAGLE transported Rowland and Strazanac to Nihoa Island; dropped supplies at Tern Island; and continued on to Laysan. There it picked up Niethammer, McDermond, and Conant and headed back down the chain to Tern Island where Niethammer and Conant were dropped off and returned to Honolulu via our aircraft contractor. McDermond continued on to Necker with the vessel, where he conducted a one day reconnaissance of the island. From there the vessel continued on to Necker and picked up Rowland and Strazanac. The vessel then continued on to Kauai where personnel were dropped off and returned to Honolulu via commercial airlines. The vessel continued on to Honolulu with the expedition gear.

## J. OTHER ITEMS

### 1. Cooperative Programs

The NOAA vessel TOWNSEND CROMWELL continued to provide free transport of supplies, food, fuel, equipment, personnel and correspondence. Because of this important logistic support, which would cost the Refuge thousands of dollars to obtain otherwise, the National Marine Fisheries Service monk seal research program is not charged use fees for their stays at Tern Island.

Due to time constraints, the Refuge did not issue a Special Use Permit to the TOWNSEND CROMWELL in 1990. This permit is normally issued to allow them entry into the Refuge and it sets forth special conditions relating to this activity. Issuance of this permit has helped to educate vessel personnel to the sensitivity of the islands. It gives the vessel captain the responsibility of providing needed freezer space to field personnel for their equipment. In the past, poor coordination between field and vessel personnel had allowed untreated field equipment to be landed on the island and thereby increased chances of introductions of exotic species.

NMFS and the Refuge worked together for the third year in a row to monitor green sea turtle populations at French Frigate Shoals. In this cooperative effort the Refuge hired 2 Biological Technicians, provided logistic support, food, and equipment for a 6 month effort to tag turtles on East Island. NMFS provides technical assistance and analyzes data that is collected to estimate a nesting population (See section D.5).

Refuge staff provided logistical support to NMFS at French Frigate Shoals and for their field camps on other refuge islands. In addition, numerous radio checks were conducted for safety purposes and to relay messages between Honolulu and other camps. Tern Island personnel regularly monitored intra-atoll radios in support of NMFS research.

The Honolulu office assisted with transportation arrangements for one trip (4 through 7 June) to Tern by the National Weather Service. Tern Island personnel also performed regular preventative maintenance and emergency repairs to the RAMOS weather station.

Tern Island personnel recorded information from the University of Hawaii tide gauge and performed regular and emergency maintenance.

Refuge staff assisted with logistics and volunteer coordination support for Midway Atoll NWR and Johnston Atoll NWR.

### 3. Items of Interest

On November 9th a 620' Chinese freighter the MAI GU HAI anchored several miles southwest of the Refuge boundary at French Frigate Shoals. The vessel radioed the Coast Guard that it was in danger of breaking up. It was carrying barium sulfate ore. Salvage tugs were on scene and eventually the vessel limped back to Honolulu.

Refuge Manager McDermond attended the annual meeting of the Pacific Seabird Group in Victoria, British Columbia. He presented a paper on the Status and Conservation of North Pacific Albatross.

### 4. Credits

This narrative was prepared by Ken McDermond, Craig Rowland, Ken Niethammer, Jennifer Megyesi, Beth Flint, and Marc Webber

Photos: Ken McDermond (DKM)  
Kenneth Niethammer (KRN)  
Jennifer Megyesi (JLM)  
Gene Kridler (GK)  
Craig Rowland (CR)

# **APPENDIX A**

**NORTHWESTERN  
HAWAIIAN ISLANDS  
REFUGE COMPLEX**

**Hawaiian Islands  
National Wildlife Refuge**

Nihoa Island  
Necker Island  
French Frigate Shoals  
Gardner Pinnacles  
Maro Reef  
Laysan Island  
Lisianski Island  
Pearl & Hermes Reef  
and  
Midway Atoll National Wildlife Refuge

## Refuge Fact Sheet

Date: October 1989

Refuge: Hawaiian Islands National Wildlife Refuge

Date Established: Established by Executive Order 1019, on February 3, 1909

Acreage:

<u>Island</u>	<u>Emergent</u>	<u>Submergent</u>	<u>Total</u>
Nihoa	168	--	168
Necker	47	--	47
French Frigate Shoals	73	104,794	104,866
Gardner Pinnacles	5	--	5
Maro Reef	--	53,387	53,387
Laysan	997	734	1,732
Lisianski	365	--	365
Pearl & Hermes Reef	87	93,764	93,850
TOTAL	1,740	252,680	254,418

Legislative District: City and County of Honolulu

Location: The Hawaiian Islands National Wildlife Refuge consists of a chain of islands, reefs, and atolls extending about 800 miles in a northwesterly direction from the main Hawaiian Islands.

Mandates: In his Executive Order, Theodore Roosevelt "set apart" the "islets and reefs" of the Hawaiian Islands National Wildlife Refuge "as a preserve and breeding ground for native birds."

Land Status: The Fish and Wildlife Service has jurisdiction for these areas.

Policy Direction: The Refuge is managed for the protection, enhancement and preservation of seabird colonies and endangered species. Special provisions are required for travel to these remote islands to ensure that introductions of alien plants, insects, and rodents do not occur. The Hawaiian Islands National Wildlife Refuge Master Plan was officially adopted in November 1986.

### Landscape Characteristics:

The northwestern Hawaiian Islands consist of geologic types of high islands such as Nihoa and Necker, low islands such as Laysan and Lisianski, and atolls such as Pearl and Hermes Reef and French Frigate Shoals. Because of their geographic isolation, the islands have provided a unique "window" on biological evolution. Many of the endemic floral and faunal species found on the Refuge exist nowhere else in the world. The Refuge is the entire range for the endangered Hawaiian monk seal, Laysan duck, Laysan finch, Nihoa millerbird and Nihoa finch, and is the breeding ground for virtually all of the threatened Hawaiian green sea turtles. The most abundant wildlife forms occurring on the Refuge are seabirds. The Refuge is breeding ground for 18 different species, numbering 12-14 million birds. These islands provide breeding habitat for a substantial portion of the worldwide population of at least four of these 18 species: the black-footed albatross, Laysan albatross, Bonin petrel, and sooty storm petrel. The future of these species depends upon keeping the island environments free from detrimental changes. This is especially critical because of the fragile nature of these remote island ecosystems. The waters surrounding the Refuge harbor a rich abundance of living resources, many of which have considerable economic importance. The nearshore marine community includes about 700 species of fish, of which about 20% are endemic to Hawaii. Commercial harvest of fishes could have potential consequences for refuge wildlife resources.

The Refuge is the site of some significant archeological resources. Ruins consisting of house terraces, ceremonial structures, burial caves, shelters, and agricultural terraces are located on Nihoa and Necker Islands. Nihoa and Necker Islands are listed on the National Register of Historic Sites.

Public Use: Entry is by Special Use Permit (Permit) only, primarily for management-related research purposes. Interpretation and Recreation is closely tied to Kilauea Point. Permits are also issued for photography, journalism, and art purposes. Access to Nihoa and Necker is possible for religious purposes. Approximately 10-15 Special Use Permits are issued annually.

Issues/Needs:

1. a. Management of deteriorated sea wall, underground storage tanks and buried debris.
- b. Funding for Tern Island operations.
2. Noxious alien plant and insect control.
  - a. Alien plants such as Cenchrus are replacing native vegetation.
  - b. Alien insects such as Pharaoh ants may affect endangered finch populations.
3. Funding for boat charter for multi-purpose visits to the Refuge.
4. Master Plan implementation.

prepared by: Stewart I. Fefer

# HAWAIIAN AND PACIFIC ISLAND NATIONAL WILDLIFE REFUGE



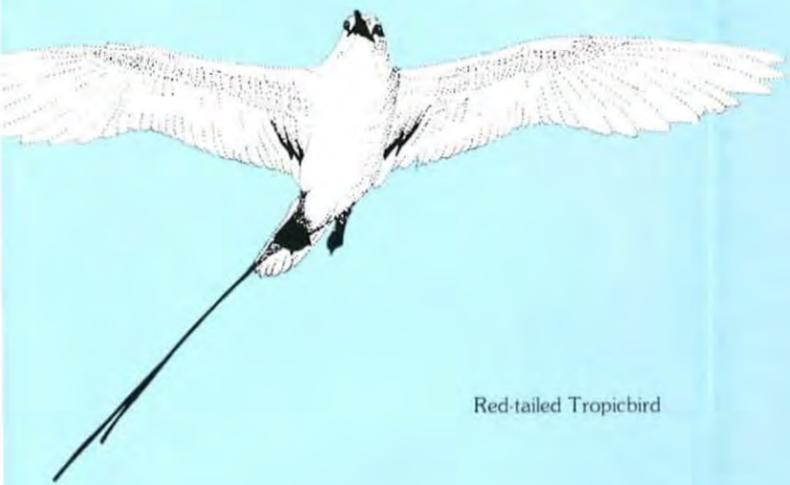
Masked Boobies



**For more information:**

U.S. Fish and Wildlife Service  
 300 Ala Moana Blvd., Rm. 5302  
 P.O. Box 50167  
 Honolulu, Hawaii 96850  
 (808) 541-1201

Red-tailed Tropicbird



# THE WETLAND REFUGES

## Some Interesting Facts About Hawaiian Waterbirds and Wetlands

- The Hawaiian cormorant, Hawaiian noddie, and Hawaiian duck are found only on the main Hawaiian Islands—they don't migrate to the mainland.
- The native birds are joined from September to April by pintails, shovellers and other waterfowl that migrate thousands of miles from Canada, Alaska or Russia.
- Shorebirds like plover, tattler, turnstones and sandpeeps also make the same annual migration from the mainland that waterfowl do.



Ruddy Turnstones

## Mainland Migrants and Other Residents also Benefit from Hawaiian Wetlands.

More than two dozen species of ducks and geese occasionally migrate to Hawaiian wetlands for the fall to spring seasons. The most common species are pintails and northern shovellers that breed in North America.

Black-crowned night herons are common residents of the Hawaiian Islands. They feed on fish and invertebrates but may also take young waterbirds.

A diverse group of migratory shore birds also winters in Hawaii. They visit wetland refuges where suitable mudflats or shallow water habitats are available. Pacific golden plovers, sandpeeps, wandering tattlers and ruddy turnstones are most common.

## Habitats are Acquired and Managed to Enhance Waterbird Use

All birds using the Hawaiian wetlands need appropriate foods and freedom from disturbance. The endangered waterbirds that only nest in Hawaii also need protection from predators.

A dependable water supply is necessary to support the waterbirds. Controlling water levels in various ponds can create conditions favorable for certain plants, insects and other organisms which in turn are food for the birds.

Creating artificial islands in refuge ponds separates bird nesting areas from dogs, cats and mongoose. Mammal-proof fences afford protection from feral dogs.

## Habitat Loss and Predators Endanger the Waterbirds

Formerly more common and more widely distributed, these species have experienced population decline due to continuing loss of habitat, introduced predators and, to some extent, harvest by man. Although celebrated in legends of early Hawaiians, these species were hunted for feathers and food, and more recently were hunted for sport until protected prior to World War II. Housing and resorts continue to expand into existing or potential marsh habitat in the Hawaiian Islands. The natural variety of habitats and quality of water and food supply was greater in the past before the wetlands were converted to other uses.

## Point National Wildlife Refuge,



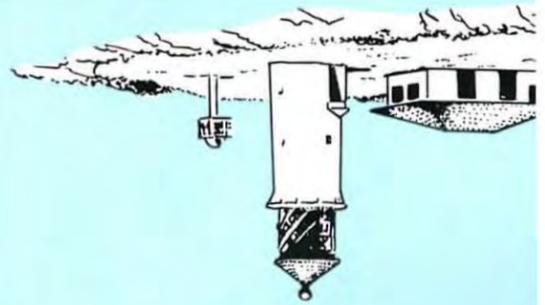
visitors come to Kilauea Point each year to view and marine mammals, to photograph and enjoy the scenery and the historic old lighthouse. The light- built in 1913 and placed on the National Register of es in 1979.

at Kilauea Point NWR describe some of the wildlife of the five wetlands refuges and the six remote island se refuges and their significance are briefly described

located 1 mile north on a paved road from Kilauea highway on the north coast of Kauai, Hawaii.

## of Seabirds

es of wedge-tailed shearwaters and red-footed as the Laysan albatross, the great frigatebird, and f tropicbird.



## ours

NWR is open to the public Sunday through Friday. m. These hours will be expanded as staff and volun- available.

natural history books is offered at the lighthouse

# THE REMOTE ISLAND REFUGES

## Some Facts About Remote Pacific Islands and Wildlife

Over 5 million seabirds (18 species) nest on less than 2,000 acres on the northwestern Hawaiian Islands.

Many seabirds roam the Pacific Ocean for several years before returning to remote islands to nest.

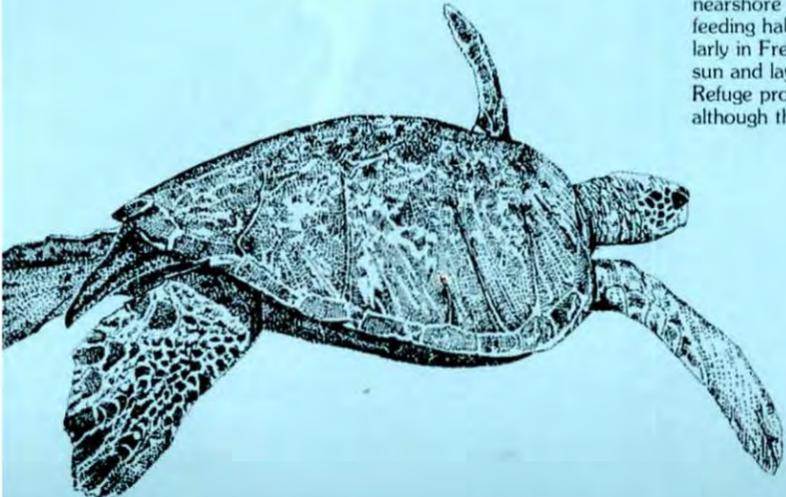
Frigatebirds fly continuously when at sea. Their feathers won't repel water like some other seabirds. To supplement the fish they catch, frigatebirds frighten boobies and shearwaters and take their food. Hawaiians called them Iwa, which means "thief".

Albatrosses don't nest until they are about seven years old. They will choose their mates and nest together each year for life. They may live over 30 years.

250,000 acres of submerged reefs surrounding 1,800 land acres of the remote Hawaiian Islands NWR provide habitat for fish and other life which in turn feed millions of seabirds.

Green Sea Turtles that nest on Pacific islands may roam several hundred miles in search of feeding areas.

As an experiment albatrosses were flown blindfolded to Alaska, San Francisco, Los Angeles, Australia and other points. Upon release they flew back to Midway Island (1,500 miles west of Honolulu) within 10 days.



## Remote Island NWRs—Tiny Wildlife Oases in the Vast Pacific Ocean

Mere dots in the vast ocean, the remote mid-Pacific islands host breeding monk seals, turtles and millions of seabirds. They nest on rocky islands and islets among coral atolls.

The marine environment on the remote island refuges is largely undisturbed by commercial exploitation and consequently many species are unusually abundant. The relatively pristine nature of the nearshore waters and the importance of this habitat to seals, turtles and seabirds led to the inclusion of large bodies of protected lagoon and nearshore waters into the boundaries of various remote island refuges.

There are more than 14 million seabirds of 18 species on the Hawaiian Islands NWR alone. Sooty Terns are the most abundant nesters on the remote islands. Also common are albatrosses, shearwaters, petrels, tropicbirds, frigatebirds, boobies, and noddies.

The terrestrial habitat of the Hawaiian Islands National Wildlife Refuge is shared by endemic land birds on the small islands of Nihoa and Laysan. The Nihoa finch and Laysan finch are representatives of the unique Hawaiian honey creeper subfamily that includes several more species in the main Hawaiian Islands. The Nihoa millerbird is an endemic representative of an old world warbler family confined in distribution to this 168 acre island. A close relative formerly found on Laysan Island is now extinct, as is a flightless rail and honeycreeper that inhabited the same island. All three birds were indirect victims of a short but devastating period of human exploitation for guano and feathers which was stopped early in this century when this refuge was established. One additional species, the Laysan duck, barely survived this period and has made a significant comeback.

The Hawaiian monk seal is another endangered species confined in distribution to the Hawaiian Islands NWR. Beaches and rocky shelves on several islands provide space to haul out and rear their pups, while nearshore waters within and adjacent to the Refuge provide critical feeding habitat. These seals share the beaches of sandy islets, particularly in French Frigate Shoals, with green sea turtles that bask in the sun and lay their eggs in sand pits during the summer months. The Refuge provides the primary breeding habitat for the green sea turtles, although the species ranges widely into the main Hawaiian Islands.

## Managing Remote Islands for Wildlife.

The remote island refuges are manipulated only where it is necessary to control predators, exotic plants or other factors adversely affecting the habitat or resident wildlife. Public access is severely restricted because of the history of abuse and slow recovery of these vulnerable areas when disturbed. Even research activities are closely scrutinized to minimize unnecessary disturbance and are confined largely to projects likely to yield important management data. A refuge field station is operated at Tern Island in the French Frigate Shoals, Hawaiian Islands NWR.

## Remote Island Refuges

**Hawaiian Islands NWR**—This Refuge, the oldest and largest in the complex was designated in 1909 by President Theodore Roosevelt. The Hawaiian Islands NWR includes all the emergent rocky islands, sandy islets and major atoll lagoons between Nihoa Island and Pearl and Hermes Reef in the northwestern portion of the Hawaiian Archipelago. In total, nearly 1,800 acres of emergent land and over 250,000 acres of submerged land are included. Remnants of prehistoric occupation by early Polynesians are also protected on Nihoa and Necker Islands.

**Johnston Atoll NWR**—This Refuge is located 825 miles southwest of Honolulu. The Refuge is managed cooperatively with the Defense Nuclear Agency. Twelve species of seabirds breed on four islands within the atoll. The reef community in the lagoon supports diverse marine life including green sea turtles. The atoll was first protected as a federal bird refuge in 1926, although it has been used extensively as a military installation since 1939.

**Jarvis Island NWR**—Jarvis is part of the Line Islands Archipelago and is located just below the equator, 1,300 miles south of Honolulu. The island is about 1,100 acres in size. The Refuge also includes 36,419 acres of adjacent submerged lands. Like Baker and Howland the island is believed to have been discovered by European sailors early in the 18th century and was also exploited for its guano resources. Eight species of migratory seabirds are known to nest on Jarvis Island. Feral cats were at one time found on all three of the equatorial refuges where they preyed heavily on nesting seabirds. They were successfully eradicated from Baker in 1964 and Jarvis in 1983. All three islands were designated as National Wildlife Refuges in 1982.

## Four Endangered Waterbirds are Found on the Wetland Refuges

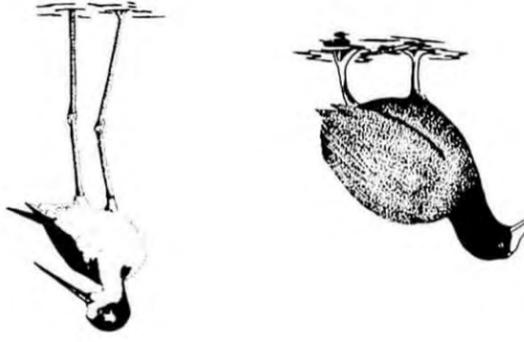
Wetland refuges on the main islands support four endangered waterbirds that are unique to Hawaii.



**Hawaiian Duck or Koloa Maoli**—is similar to though smaller than the common mallard. **Koloa Maoli** are most common on Kauai where they inhabit natural and artificial ponds, streams, ditches and marshes.



**Common Moorhen (Hawaiian Gallinule)**—is related to the coot and is found in similar habitats. It is distinguished by its bright red bill and forehead. Its Hawaiian name is **'Alae Ula**.



**American (Hawaiian) Coots**—are easily recognized by their white floating nests built from aquatic vegetation. Their Hawaiian name is **'Alae Ke'oke'o**.



## James Campbell NWR (Oahu)—This Refuge was established in 1977 through the lease of 142 acres of land in two major parcels from the James Campbell Estate. The Refuge includes the spring-fed Punamano Pond and a series of remnant cane wash water settling basins known collectively as Kii Unit. Prior to the closing of the Kahuku Sugar Mill in 1971, these settling basins provided important habitat for stilts, coots, and gallinules. This habitat is being restored and enhanced through major modifications to the impoundments and water system to provide manageable nesting and feeding areas. The Refuge is open to the public on certain weekends and at other times by special permit.

**Pearl Harbor NWR (Oahu)**—This 40-acre Refuge was established in 1977 on Navy lands in an effort to compensate for loss of still feeding habitat when a reef runway was added to the Honolulu International Airport. The Honolulu Unit was constructed at the site of remnant salt evaporation ponds through the excavation of new ponds with several nesting islets. Similar habitat was created for the Waiawa Unit at the northwest side of Waiawa Peninsula. These units were created primarily for Hawaiian Stilt, but other resident and migratory birds use them also. The Refuge is open by special permit only.

## Public Uses are Limited by Size of Refuges

Public use of wetland refuges is limited because the areas are small and human visitors can disturb the endangered birds.

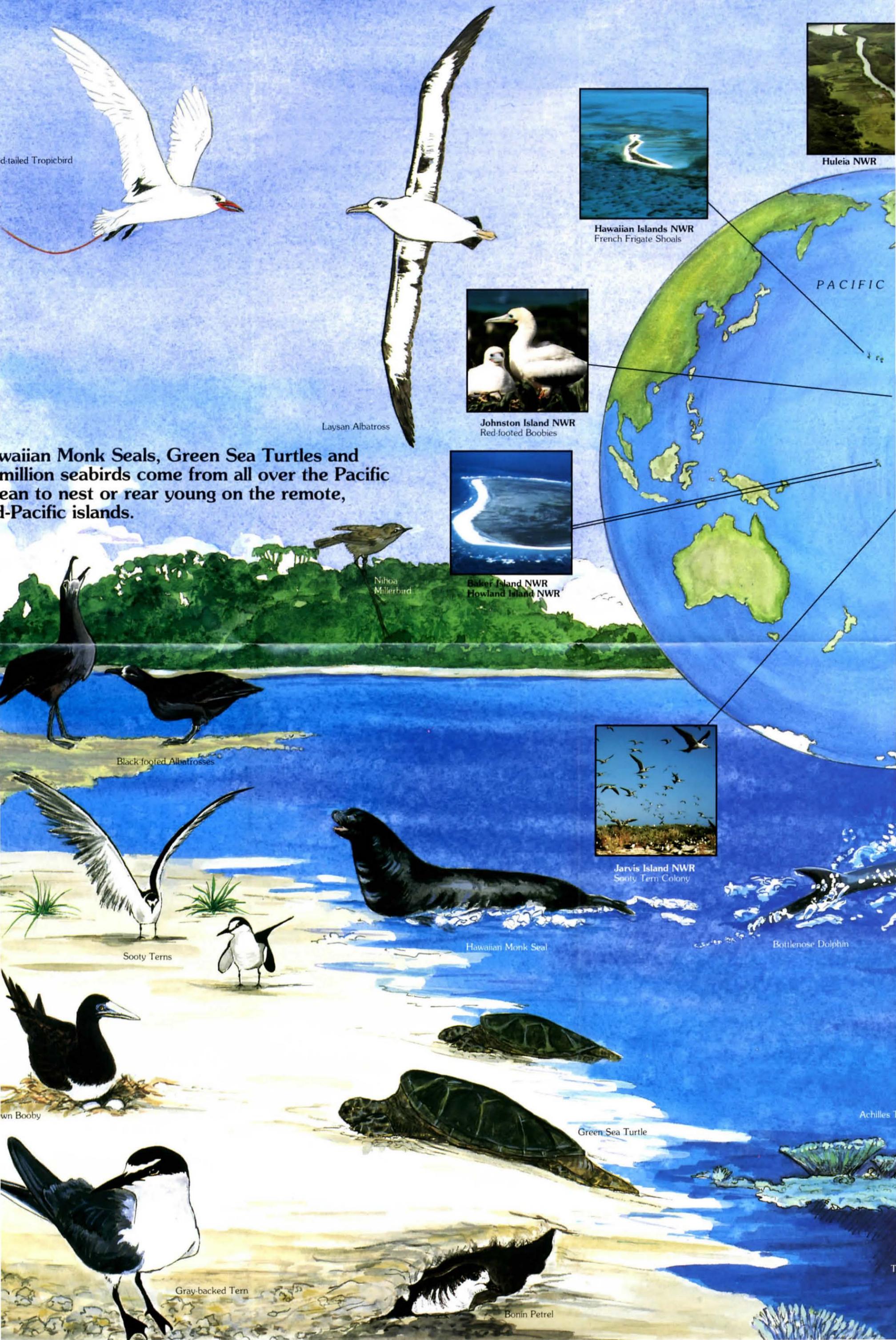
## Wetland Refuges

**Hanalei NWR (Kauai)**—This Refuge established in 1972 includes 917 acres of the lush Hanalei valley. Taro is commercially raised on a portion of the Refuge by permittees. A by-product of this system is good habitat for all four endangered waterbirds. A new taro system replacing the historic hand-dug irrigation ditches has limited the acreage of taro and other wetlands to increase. The Refuge is not open to the public. An interpretive overlook on the state highway north of the Refuge explains the Refuge values and affords a spectacular view.

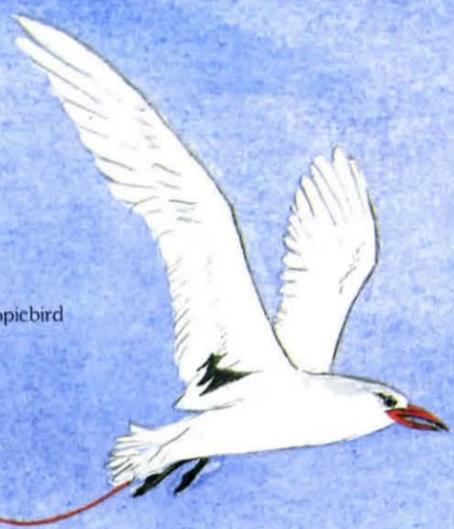
**Huleia NWR (Kauai)**—In 1973 approximately 240 acres of rippled slopes and bottom lands along the Huleia River were purchased to provide additional waterbird habitat. The Refuge includes ponds formerly in taro and rice that will be modified extensively to attract endemic waterbirds to new breeding and feeding areas. The Refuge lies adjacent to the famous Menehune Fish Pond, a registered national historic landmark. The Refuge is not open to the public. It can be seen from the Menehune overlook along the road.

**Molokai NWR (Molokai)**—This Refuge, established in 1976, includes a remnant inland freshwater fish pond along the south coast of Molokai. This pond was expanded in 1983 to enhance habitat for and coots. The county of Maui operates a small beach park on

# HAWAIIAN AND PACIFIC ISLAND



Red-tailed Tropicbird



Laysan Albatross



Hawaiian Islands NWR  
French Frigate Shoals



Huleia NWR



Johnston Island NWR  
Red-footed Boobies



Baker Island NWR  
Howland Island NWR

Hawaiian Monk Seals, Green Sea Turtles and million seabirds come from all over the Pacific Ocean to nest or rear young on the remote, island-Pacific islands.



Niihau Millerbird



Black-footed Albatrosses



Jarvis Island NWR  
Sooty Tern Colony



Sooty Terns



Hawaiian Monk Seal



Bottlenose Dolphin



Brown Booby



Green Sea Turtle

Achilles T



Gray-backed Tern



Bonin Petrel

# S NATIONAL WILDLIFE REFUGES



Hanalei NWR



Kilauea Point NWR



James Campbell and Pearl Harbor NWRs



Kakahaia NWR



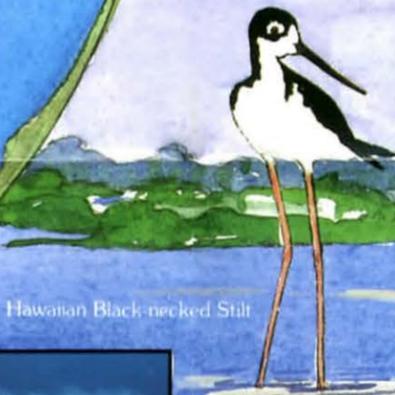
Great Frigatebird



Northern Pintails

Marshes and ponds on the main Hawaiian Islands support endangered resident waterbirds and migrating waterfowl and shorebirds from the North American mainland and other continents.

OCEAN



Hawaiian Black-necked Stilt



Rose Atoll NWR



Pacific Golden Plover



Sanderlings



Wandering Tattler



Common Moorhen (Hawaiian Gallinule)



Hawaiian Coots



Hawaiian Duck (Koloa Maoli)



Black-crowned Night Heron



Acropora Coral



C. HOLLEN