

REVIEW AND APPROVALS

MIDWAY ATOLL NATIONAL WILDLIFE REFUGE

Midway Atoll, Pacific Ocean

ANNUAL NARRATIVE REPORT

Calendar Year 1993

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Red-footed boobies

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

INTRODUCTION

Midway Atoll National Wildlife Refuge (NWR) is located in the North Central Pacific Ocean at 28°12'N latitude and 177°22'W longitude. It is about 1150 miles west-northwest of Honolulu, Hawaii. As a U.S. possession, it is the only atoll in the Hawaiian Island chain not within the State of Hawaii. The Refuge covers approximately 77,000 acres of water (3 miles beyond the atoll reef) and has three flat coral islands totaling about 1,550 acres.

Midway Atoll NWR was created in April, 1988 by Cooperative Agreement between the Navy and the Fish and Wildlife Service. Midway Atoll NWR overlays the lands and waters of Naval Air Facility (NAF) Midway Islands. The Refuge was established for the conservation of endangered species, migratory birds, and other fish and wildlife. The first permanent Refuge office opened on Sand Island on November 23, 1990. Although various research and management activities were conducted at Midway during previous decades, establishment of the office provided the Service's first full-time presence.

The Navy retains primary jurisdiction for the atoll. The Commanding Officer Naval Facilities Engineering Command, Pacific Division, Pearl Harbor, Oahu, Hawaii commands NAF Midway Islands through an on-site Officer-in-Charge (OIC). Base operations and maintenance are executed by a base contractor. In June 1992, Piquini Management Corp. (PMC) was selected as the base operations support contractor. They under bid Base Services Inc. who had the base contract for the past 10 years.

NAF Midway went into operational base closure on October 1, 1993. Planning for clean-up activities are currently in progress. The population of Midway was reduced from about 300 military and civilian contract personnel and spouses in the fall of 1990 to a little under 200 by the end of 1993. By December, there were one Navy officer and three Chief Petty Officers. The base contractor has a staff of 20-30 American supervisors and technicians. The remaining employees are third country nationals from Sri Lanka, Thailand and the Philippines.

The Refuge provides nesting and roosting habitat for over a million seabirds of 15 species, wintering habitat for three common shorebirds, and marine habitat for a diverse assemblage of marine animals, including endangered Hawaiian monk seals (*Monachus schauinslandi*), threatened green sea turtles (*Chelonia mydas*) and Hawaiian spinner dolphins (*Stenella logirostris*). Midway has the world's largest Laysan albatross (*Diomedea immutabilis*) colony and the largest colonies of red-tailed tropicbirds (*Phaethon rubricauda*), black noddies (*Anous minutus*) and white terns (*Gygis alba*) in the Northwestern

Hawaiian Island chain. One or two non-breeding, short-tailed albatrosses (*Diomedea albatrus*) typically visit Midway Atoll during the albatross breeding season.

MIDWAY ATOLL NATIONAL WILDLIFE REFUGE

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A. HIGHLIGHTS

Transplanted Hawaiian monk seals die (Section D-5).

Bonin petrel study initiated (Section D-5).

Wildlife Biologist Don Williamson departs Midway NWR (Section E-1).

Naval Air Facilities Midway Island under goes operational base closure (Section E.8).

Site preparation for removal of underground storage tanks begin (Section F-14).

Brown noddy monitoring study initiated (Section G.5).

Short-tailed albatross lays egg (Section G.7).

B. CLIMATIC CONDITIONS

Midway Atoll has a semi-tropical, oceanic climate generally influenced by moderate northeasterly to easterly trade winds, although strong winds from any direction may occur throughout the year. Heavy rains are common most winters providing an adequate supply of drinking water. NAF Midway closed its weather station in 1991. No weather data were collected by the Refuge in 1993.

D. PLANNING

4. Compliance with Environmental and Cultural Resource Mandates

In early March, the Kure Island Loran tower with peeling lead paint chips was finally covered after an October 1992 storm ripped open the original plastic covering. The tower was stored on Midway until the U.S. Coast Guard could arrange its shipment off Midway.

5. Research and Investigations

MID-01-93 Hawaiian Monk Seal Research. National Marine Fisheries Service

On 7 January three rehabilitated Hawaiian monk seals arrived on the AMC flight with National Marine Fisheries Service (NMFS) biologist John Henderson who released them with the assistance of the refuge staff.

On 20 May, three NMFS volunteers arrived to determine the fate of about 20 rehabilitated seals that were released on Midway the previous year. By the time of their departure on 1 July, only two of the rehabilitated seals were sighted on the atoll.

MID-02-93 A Pilot Study of Contaminant Uptake in Two Species of Albatross in the North Pacific Ocean: The SERE Group, Ltd

Chlorinated synthetic contaminants, particularly the planar chlorinated hydrocarbons (PCH), and certain insecticide residues have damaged wildlife in some regions. This research seeks to confirm the presence of PCH and other chlorinated contaminants in the pelagic albatrosses of Midway and to evaluate the presence of toxic effects in the young of these albatrosses. The objectives include measuring the rates of deformities and abnormalities in chicks, the variance in levels of the thyroxine and vitamin A biomarkers in chicks and adults and how these vary with contaminants and age in individuals.

Representatives of the SERE Group were present on Sand Island from January 28 to March 11 and May 6 to June 24. Blood from adult and near fledging chicks of both black-footed (*Diomedea nigripes*) and Laysan albatrosses were collected. A total of 670 nonviable eggs were collected. Two hundred twenty-five embryos were examined. About 19% of the Laysans and 22% of the black-foots had some deformity. The black-foot sample was small. The SERE Group banded 5,000 chicks (2,500 of each species). They examined plastic contents from 295 dead chicks of near fledging size. Plastic contents in the proventriculus ranged from 0-250 g. There were no correlation between fat reserves and stomach contents.

MID-03-93. Evaluation of Reef Fish Impact on Hawaiian Monk Seals at Midway Atoll: National Marine Fisheries Service.

During 5-19 August, reef fish abundance and biomass were assessed at Midway Atoll. The survey, a continuation of work begun at French Frigate Shoals in the summer of 1992, attempted to assess changes in the reef fish assemblage which might impact the forage base of newly weaned Hawaiian monk seals. The surveys were conducted at the same locations as fish surveys of the early 1980's completed by the Hawaii Cooperative Fishery Research Unit. Eight of nine historical stations in three major habitats (outside barrier reef, inside barrier reef, and lagoonal patch reefs) were successfully resampled. Once analyzed the results will be compared with similar stations sampled at French Frigate Shoals to provide a broader evaluation of reef fish in the Northwestern Hawaiian Islands.

Diver biologists also collected approximately 200 specimens of two species of reef fish from three other sites within each of the major habitats. The fish collected, the wrasse *Thalassoma ballieu* and the surgeonfish *Ctenochaetus strigosus*, were divided into three specific size classes. These specimens were sent to the NMFS Charleston Laboratory for accurate analyses of ciguatera toxin. The design should allow a novel evaluation of the effects of body size within fish species and the effects of reef site within habitat type on the incidence of ciguatera toxin in potential reef fish prey.

MID-04-93. Collection of Reef Fishes and Invertebrates on Midway Atoll. Waikiki Aquarium.

Aquarium personnel and subpermittees arrived on 27 May and departed on 10 June. Fives species including eight fishes were collected. An additional six species of fish and invertebrates were collected for DNA analysis by a subpermittee. An additional 70 opisthobranchs were collected and deposited at the California Academy of Sciences. Among these specimens were records of range extensions and probably few new species.

MID-09-92. Effects of Rat Predation on Bonin Petrel (*Pterodroma hypoleuca*) Reproductive Success at Midway Atoll. U.S. Fish & Wildlife Service.

Cooperative education student, Nanette Seto, conducted her first of a two year study examining the effects of black rat (*Rattus rattus*) predation on Bonin petrel reproductive success. Seto's study included six study areas on Sand Island. Three of the study areas were treated with rodenticide while the remaining three areas were not. Nine covered and secured plastic bait stations were placed in each of the three treatment areas on a 50 m grid system. Treatment was applied from March through June. Treatment could not be started at the beginning of the egg laying period of the petrels because of delays by the U.S. Navy in granting Seto permission to use the rodenticide.

Seto monitored 131 nests from egg through chick fledging. A fiberoptic scope was initially used to examine burrow contents until its failure. After which a closed circuit miniature camera system hooked up to a small monitor was used. Hatching, fledging, and reproductive success in each area were calculated. Reproductive success numbers ranged from 0.00% to 86.96%. Causes of nest failure include rat predation, nest abandonment, and burrow destruction. Burrow destruction may have been caused naturally by albatrosses or erosion or by humans. Direct evidence of eggs taken by rats were found in five burrows. These included broken egg shell remains. If a

burrow was found empty with no signs of the egg, it was concluded that egg was removed by a rat. Out of the 131 nests monitored, 45 nests failed due to rat predation, 1 nest was abandoned, 1 nest's occupants kicked out the egg, and 6 failed because of burrow destruction (one of which was during the egg stage, the remaining 5 occurred during the chick stage). Thus, 48 nests failed during the egg stage and 5 failed during the chick stage. There were no observations of rat predation on chicks.

In addition to monitoring the Bonin petrel nesting activity, Seto attempted to conduct mark-recapture studies to estimate rat density in each of her study areas. Wire dome-shaped live rat traps (Haguma brand) was used to capture rats. Twenty traps were placed on a 20 m grid system in each study area. Trapping was conducted five nights per week on alternate weeks beginning 2 February through 12 June 1993. Dried coconut flakes were mixed with peanut butter to form a "dough". The dough was rolled into small balls and wrapped in gauze and used as bait. When rats were caught the sex, coat color, and weight were recorded. Captured rats were tagged with monel ear tags on both ears before being released.

A total of 6000 trap nights were conducted for trapping rats. One trap night consists of a complete night of trapping by one trap. Of these 6000 trap nights, 635 (10.6%) were tripped, but caught nothing, 1370 (22.83%) caught mice, 55 (0.92%) caught rats, 20 (0.32%) caught Bonin petrels, and 3919 (65.33%) were not tripped. A total of 37 rats were caught. Sixteen out of the 37 rats were recaptured at least once. One individual was recaptured 11 times from 14 January through 26 May. Oftentimes, the ear tags were caught on the bait hooks of the traps and thus ripped off the ears, or parts thereof, of the rat. The weight of the rats ranged from 40 through 255 grams. A total of 19 males and 24 females were caught.

Seto concluded from preliminary results that the reproductive success of the Bonin petrels is indeed affected by predation by rats. The overall reproductive success numbers for treatment areas in comparison to control areas were higher, except for one area. Therefore, it appears that the rodenticide did affect the rat population in those study areas by reducing their numbers, the result being an increase in reproductive success of the petrels. Rat predation appeared to have the most impact during the egg stage of the petrels' breeding cycle.



Student Trainee, Nanette Seto, conducted a mark-recapture study of black rats to estimate their population at her Bonin petrel study plots. [MN 4/93]

E. ADMINISTRATION

1. Personnel

Name/Title	Series/Grade	EOD	Status
Michael L. Nishimoto Refuge Manager	GS-0485-09	05/04/92	PFT
Don A. Williamson* Wildlife Biologist	GS-0486-09	09/23/90	PFT
Nanette W.H. Seto Student Trainee/ Wildlife Biologist	GS-0499-07	12/27/94	TPT

* Don Williamson transferred to Willapa NWR 05/01/93.



Refuge Manager Nishimoto (L) and Wildlife Biologist Williamson (R). [DKM 5/92]



Student Trainee Seto. [KT 1/94]

Number of Employees

	Permanent Full-Time	Permanent Part-Time	Term	Temporary	Total FTE
FY93	1.6	0.0	0.0	0.5	2.1
FY92	2.0	0.0	0.0	0.0	2.0
FY91	0.0	0.0	0.0	1.0*	1.0
FY90	0.0	0.0	0.0	0.5	0.5
FY89	0.0	0.0	0.0	0.5	0.5

* NWR Office opened with 1 term position 11/23/90.

4. Volunteer Program

Six volunteers worked on the Refuge in 1993. At least one volunteer was present throughout the year. Volunteer terms averaged 10 weeks.

Volunteers assisted the Refuge staff with biological surveys and censuses, wildlife interpretation, preparing interpretive displays, monitoring of construction activities, rescuing trapped birds and other Refuge work.

5. Funding

The Refuge received approximately \$157,000 for FY-93. This included \$7,000 of MMS funding to replace a golf cart. An additional \$11,900 was provided by the Navy for planning of a rat eradication project.

6. Safety

Standard safety procedures were implemented. Boating safety is of paramount importance at Midway. No safety problems occurred during the year.

8. Other Items

Fish & Wildlife Service Personnel Visits

In January, Ray Rauch, Project Leader Hawaiian/Pacific Islands Complex visited Midway along with refuge managers from Pacific/Remote islands, Oahu and Kilauea Point. Also on the trip were Brooks Harper from Ecological Services and Thierry Work of the Wildlife Health Lab.

Chief, Division of Environmental Contaminants, Donald Steffeck conducted a week-long investigation at Midway with Honolulu Environmental Contaminants Specialist Chip Demarest and John Hale beginning March 4. They generated a map and report on potential contaminated sites.

Deputy Project Leader, Hawaiian and Pacific Islands NWR Complex, Jerry Leinecke visited Midway March 25 to April 3 to coordinate Service efforts on the removal of underground storage tanks. Technical assistance was provided by Demarest and Hale. The project is being funded by the Navy.

While on this trip, Leinecke and Demarest enclosed cables used as a barrier with empty sono buoy tubes. The cable had previously killed or injured numerous albatrosses.



Sono buoy tubes were used to mitigate impacts of a barrier cable that were a source of mortalities for albatrosses. [MN 4/93]

The Service chartered vessel *Golden Eagle* arrived in August to transport researchers to Laysan Island, Northwestern Hawaiian Islands NWR.

Chip Demarest, Ecological Services-Honolulu, spent a week on Midway during the last week of September to assist three Ogden Environmental representatives in identifying environmental problems that may require clean-up with base closure. Ogden Environmental was funded by the Navy.



Chip Demarest, Ecological Services-Honolulu and an Ogden Environmental, Inc. representative discuss contaminants issues on Midway. [MN 9/93]

NAF Midway Islands

A small Pony Express exercise was conducted during late April.

Captain Steve Daignault of PACDIV Naval Facilities Engineering Command arrived on Midway in September to be briefed on NAF Midway Islands issues including wildlife concerns. The Naval Facilities Engineering Command would be the entity that administers Midway during the environmental clean-up of the base.

In September, PACDIV environmental planning biologist, Tim Sutterfield accompanied three PACDIV engineers who inspected buildings on Sand Island as well as Eastern to determine the feasibility of demolishing them.

On 18 September, Navy biologist Lawrence Pinter arrived with two U.S. Forest Service personnel who continued their research on ground termite near NAVFAC. The project is expected to continue during operational base closure.

On 1 October, an operational base closure ceremony was held at the Midway Memorial. Commanding Officer of NAS Barbers Point, Captain Rocklein participated in the closing ceremony along with LCDR Driggers. Also arriving for this event were television and newspaper reporters.



Officer-in-Charge, LCDR Michael Driggers speaks at the "Operational Base Closure Ceremony" on October 1, 1993. [TM 10/93]

OIC LCDR Driggers departed Midway on 29 October after completing his tour at NAF Midway Islands. He was the last Officer-in-Charge while NAF Midway Islands was an operational base. On 19 October, we presented LCDR Driggers with a plaque expressing our appreciation for his support of the Refuge and his concern for the wildlife of Midway Atoll NWR.

LCDR Ed Eng of PACDIV NAVFAC Engineering Command arrived on 8 November to serve as an interim OIC. He departed two weeks later. He was replaced by LCDR Dave Watts. LCDR Jim Ray arrived on 20 December to become the permanent OIC.

Pigunig Management Corporation

In February, PMC hired Mr. Lee Persinger as their new project manager replacing Mr. Ben Milam. PMC is the base operations support contractor for NAF Midway Islands.

Vessel Arrivals

The U.S. Coast Guard cutter *Jarvis* arrived on 7 January and departed that same day. She carried a crew of 180.

The tanker *Sealift China Sea* arrived on 18 January and departed the following day.

The U.S. Coast Guard cutter *Rush* arrived on 25 March and departed 27 March. She carried a crew of about 160.

In March, the cargo vessel *Osmaru* transporting canola from British Columbia anchored outside the entrance of the channel when canola expanded after water entered the hold. The ship was observed listing towards her bow. The Coast Guard and a variety of marine experts arrived on Midway where a decision was made to dump the canola at sea. The Refuge recommended that canola be discharged at least three miles beyond the atoll under seas that would transport the cargo seaward. The recommendation was accepted. On 4 April the ship departed for repairs in Honolulu.

The NOAA ship *Townsend Cromwell* arrived on 19 April and departed for Kure Island with Hawaiian monk seals that had arrived from Honolulu via the AMC log flight on 15 April.

The cargo vessel, *Maersk Constellation*, arrived on 1 May to unload much needed supplies to Midway. She departed on 3 May. She returned on 11 June to pick-up empty containers and departed the following day. The Refuge received confirmation from the ship's captain that they had picked up cargo in Guam prior to arriving at Midway. The Refuge expressed concern over the potential of the accidental introduction of brown tree snakes that has resulted in major ecological damage on Guam.

The sailing vessel, *St. Frances of the Sea* was given permission to dock at Midway to reprovision and make repairs in July. She was heading to Honolulu from Hong Kong when refrigeration equipment broke down and light winds delayed their arrival time at Honolulu.

The NOAA ship *Townsend Cromwell* arrived on 29 June to offload equipment and personnel. She departed that night.

The U.S. Coast Guard buoy tender *Sassafras* arrived on 14 July to do maintenance work on navigational aids in this area. However, she departed before completing the work.

The U.S. Coast Guard buoy tender *Sassafras* conducted navigational aids maintenance out of Midway in August. She also transported air conditioners and a freezer for the Refuge.

The U.S. Coast Guard buoy tender *Mallow* arrived at Midway on 19 October to attempt minor repairs. She departed 21 October. While here their divers removed a number of batteries disposed near a range light. Additional batteries still need to be retrieved.



The U.S. Coast Guard buoy tender *Mallow* arrived at Midway on 19 October to attempt minor repairs. [MN 10/93]

The *Townsend Cromwell* arrived on 23 October and departed 25 October.

The cargo vessel, *Maersk Constellation*, arrived on 30 October and departed the following day.

F. HABITAT MANAGEMENT

1. General

The lands of Midway Atoll NWR provide roosting and breeding habitat for tropical seabirds, migration and wintering grounds for shorebirds, haulout and pupping beaches for monk seals and basking areas for sea turtles. The expansive marine environment included in the Refuge provides habitat for a variety marine life including seabirds, marine mammals, sea turtles, fishes and other marine organisms.

3. Forests

Stands of introduced ironwood trees (*Casuarina equisetifolia*) occur on both Sand and Eastern islands. Ironwoods were removed from Spit Island in 1991.

5. Grasslands

Lawns and open areas cleared of brush and dense trees by base contractor personnel through mowing and brushing operations were heavily used by nesting albatrosses. Reduced mowing and brushing operations, as envisioned in the base downgrade, will result in loss of open grassland habitat to thick brush and forests.

6. Other Habitats

Abandoned fishing nets and other entanglement hazards for seals and turtles were removed from beaches, piers and pilings in the Refuge's marine waters.

10. Pest Control

Black rats were introduced to Midway in the early 1940's. The rats prey directly on the eggs and chicks of several seabird species. Bulwer's petrels are thought to have been extirpated by rats on Midway. The reduced populations of Bonin petrels, Christmas (*Puffinus nativitatis*) and wedge-tailed shearwaters (*Puffinus pacificus*) have been attributed to rat predation. Rats also have made major impacts on native vegetation.

Since the initial infestation, the size of the rat population has varied proportionately with the level of control effort on Sand Island.

The Navy, through its base contractor, has an ongoing program to control introduced rats in the inhabited portions of Sand Island using poison bait stations.

Animal Damage Control conducted a population survey of rats throughout the atoll in 1988. The survey showed that rat numbers were low in areas receiving control, but could be high in areas directly adjacent to these areas.

The base contractor may also conduct spot spraying to control mosquitoes and flies. Flies are also controlled by removing dead birds from the living areas of Sand Island. Usually in June, several thousand dead albatross chicks are removed each week. Buildings are periodically treated to control cockroaches.



The base operations support contractor collects dead albatross chicks to control flies on Midway. [MN 7/93]

The introduced ironwoods out-compete native shrub vegetation favored by ground nesting red-tailed tropicbirds, sooty (*Sterna fuscata*) and gray-backed terns (*Sterna lunata*) and brown noddies (*Anous stolidus*).

14. Contaminants

In March, Donald Steffeck, Chief, Division of Environmental Contaminants conducted a week long site investigation of the refuge along with Chip Demarest, Honolulu Environmental Contaminants Specialist. A map and report of potential contaminant sites were generated.

An underground storage tank removal planning team consisting of engineers from PACDIV, design contractors, Ogden, NEESA representatives, FACCO contract specialist and Ground Water Technology arrived on 25 March along with several Service personnel. Sites at both Sand and Eastern islands were inspected. There were at least 99 underground storage tank locations confirmed at twenty-eight separate sites. However, several known tanks were considered outside the scope of the project.

On 24 June, the site preparation phase of the underground storage tank removal project began at six sites. The June start up date was designed to minimize impacts on Bonin petrels that generally fledge by the end of that month. However, this was still within the breeding season of albatrosses, wedge-tailed shearwaters, red-tailed tropicbirds, black noddies and white terns.



Site preparation for the underground storage tank removal began on 24 June. Trees marked with white flagging identifies white tern nest sites. [MN 7/93]

PACDIV contracted with PMC to cut and remove ironwood trees and then cover the area with Mirafi, a geotextile material. In the past, tarps placed over albatross nesting habitat had been proven to be successful in preventing their nesting. The material would be a barrier to any burrow nesting species.

The project was monitored by two Service employees funded by the Navy. Near fledging age albatrosses were moved before tree cutting occurred to minimize their take. Wedge-tail burrows were dug up to insure that breeding birds would not be smothered when burrows collapsed. Any eggs already laid were sacrificed. Red-tailed tropicbird chicks were moved during the cutting and returned to the site under plywood A-frames. They were fed at the site after tree cutting. If it was believed that the birds were abandoned, they were placed near a Service facility where they were reared. Noddies and white terns were reared at an abandoned fire station.



White tern chicks from trees at underground storage tank sites were fostered by the Refuge staff. [MN 7/93]



Pacific/Remote Islands NWR Complex Wildlife Biologist, Beth Flint, collected wedge-tail shearwater eggs from sites that were being prepared for underground storage tank removal. [MN 7/93]

The total Bonin petrel take was two chicks. One adult and seven albatross chicks died usually as a result of being hit by falling trees. There was a total of 229 white terns taken. Of this number, 161 chicks were fostered. A take of 131 wedge-tail eggs and one adult resulted from this project. The project started just after egg laying was over for this species. Two black noddy chicks and one egg were also lost.



Sites were prepared along the pipeline alignment of underground storage tanks in the fall. [MN 10/93]

In October, additional trees were cut along pipeline routes. This would provide the contractor the flexibility of working in the area during the breeding season of tree nesting species. Petrel burrows were checked and crushed and burrows with near fledging wedge-tails were checked before the project commenced. Few noddies and white tern chicks were present, those found were given to local residents for rearing others were sacrificed.

The effectiveness of the Mirafi covered areas was tested in the albatross egg laying period during the fall. A total of 83 eggs were laid on the Mirafi. However, we estimated that the areas covered supported several thousand breeding pairs in previous years.



The "Mirafi" material used to cover underground storage tank construction sites discouraged albatrosses from nesting in the area. [MN 11/93]



Although some albatrosses laid eggs on the "Mirafi," this technique was considered a very successful albatross nesting deterrent by the Navy and Refuge. [MN 11/93]

This project demonstrated the scope of wildlife conflicts when construction activities must occur at a major tropical seabird colony.

Tarballs up to 6 inches in diameter washed up on Sand Island beaches in April. The significance of this event is unclear since there is no baseline data and no current effort to quantify tarball coverage on beaches or incidence of oiled birds. The source of the oil was unknown.

On 10 May, LCDR Driggers reported droop winged Laysan albatrosses at his residence. Paint was recently scraped from this house and was not removed. On 11 May refuge staff observed 5 droop winged birds and large amounts of paint chips. The chips were sent to Honolulu for analysis. The results indicated the presence of lead. As a result, the OIC required that when buildings or structures require scraping, all paint chips be contained and properly disposed.

The Loran Tower removed from Kure Island in 1992 was finally removed from Sand Island by the U.S. Coast Guard in July. However, lead paint chips still remained in the area and was swept up by PMC employees. The OIC requested a letter from the Refuge indicating that we were satisfied with the clean-up of lead paint chips. We had problems with the towers since it was transported and stored uncovered until we requested it covered. Wind storms ripped the covers off and it took several months to make repairs. Ironically, extreme care was taken on Kure Island to insure that all paint chips were removed.

On 20 September, a 10 gallon oil spill occurred while a tank was being filled on one of the tugs. The seas were calm enabling a containment boom to be deployed. No wildlife was impacted. The Refuge staff was not initially informed of the spill. LCDR Driggers requested that the BOS contractor notify the refuge, but we learned about the spill through a Chief Petty Officer. A critique on the spill was conducted on 28 September when we raised the issue about being notified.



The base operations support contractor conducts an oil spill drill at the inner harbor. [MN 1/93]

15. Wildlife Hazards

Electrical lines and barrier cables injure or kill a number of seabirds.

The base also has numerous fenced enclosures. Many of these enclosures allow albatross to land, but are not large enough to allow the birds to take flight and escape. Seawalls also block movement of fledglings to beaches where they remain trapped and die.

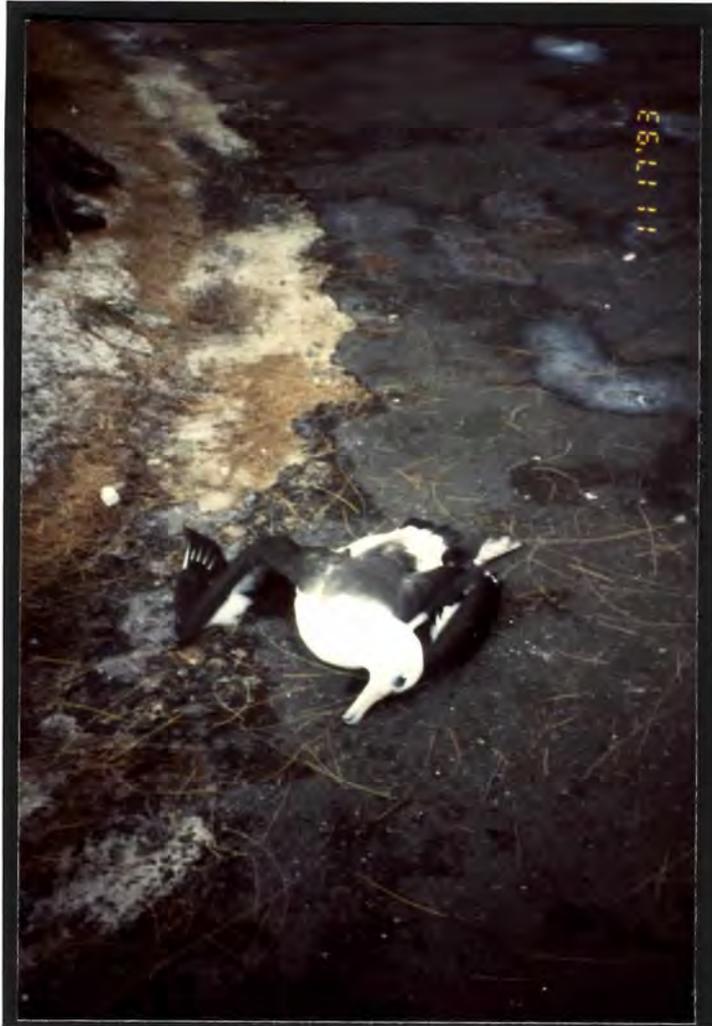


Wildlife Biologist Williamson removes a Laysan albatross trapped in beach debris. [MN 3/93]

Open water treatment tanks trap albatrosses throughout the breeding season and particularly during the fledging period. Trapped birds were removed by PMC personnel.

Street lights as well as lighting around buildings confuse nocturnal seabirds and especially fledgling Bonin petrels. The refuge requested the Navy to reduce lights around the Hangar building and several streets which resulted in a reduction of stunned and dead petrels.

Due to frequent carelessness in driving, albatross chicks were frequently run over when vehicles attempted to drive through dense concentrations of chicks. The base contractor issued a letter cautioning drivers, but mortalities still occurred. The number of vehicle mortalities, however, have decreased over previous years.



Albatross mortalities by vehicles commonly occur on Midway. This one died when it flew into the side of a moving truck. [MN 11/93]

Bird/aircraft strikes were common particularly during the spring. The birds always lose, but several strikes usually cause sufficient damage to engines to ground aircraft until a replacement engine could be sent out.

Mowing of lawns, brush cutting and tree trimming often result in the disturbance, abandonment or destruction of eggs or chicks.



Brush cutting by the base operations support contractor removed cover used by a red-tailed tropicbird chick.
[MN 6/93]



A-frames were used to mitigate the impact of brushing through red-tailed tropicbird nest sites. [MN 6/93]

Lead paint chips ingested by albatross chicks often result in their deaths. The Navy required all paint scraped from buildings be properly disposed.

G. WILDLIFE

1. Wildlife Diversity

Many islands within the Pacific/Remote Islands NWR Complex, are managed with the intent of restoring them as much as possible to their pre-human floral and faunal diversity. Currently Midway is probably far more diverse than pre-human occupation. This is due to the introduction of many plants,

animals, and insects. These introductions have often out-competed native species.

However, these changes have benefitted some native species. For example: the black noddy and white tern populations are probably above those of pre-human habitation. This is due to the introduction of ironwood trees. On the other hand, ironwood trees are not beneficial to other species such as red-tailed tropicbirds and Christmas shearwaters.

The Refuge plans activities such as rat control and selective vegetation control to restore native diversity.

2. Endangered and/or Threatened Species

Two non-breeding, endangered, short-tailed albatrosses frequented Sand Island during the breeding season. Both of these birds were known-age individuals banded with plastic leg bands (white 000 & yellow 015) by Dr. Hasegawa of Toho University, Chiba, Japan.

Midway's population of endangered Hawaiian monk seals has declined precipitously since the 1950's. The highest recorded counts occurred in 1957-58 when there was a mean of 55.7 seals. Virtually all of those seals were found on islets between Sand and Eastern islands. However in March 1968 only a single seal was observed during an aerial survey. Thereafter, the population has failed to recover. The decline has been attributed to human disturbance and its effects on reproduction and juvenile survival. After World War II, the human population of Midway declined, but increased in the 1950's to a maximum of about 3,000. There was restricted access to Eastern and Spit islands until 1968. By 1978 the human population was reduced to 250. By 1993, there were less than 200 people on Midway and access to Eastern and Spit islands were restricted. However, the seal population failed to recover. From May 1992 to January 1993, 20 juvenile females were transported to Midway. Those seals were emaciated and were rehabilitated on Oahu or sent directly to Midway from French Frigate Shoals for rehabilitation before release. By the end of 1992 four seals had died.

NMFS biologist John Henderson arrived on 7 January with three monk seals. The seals were released off the ramp southeast of the cargo dock. They had originated from French Frigate Shoals and brought to Midway in October 1992. They were not ready for release when the NMFS crew departed in December 1992 and were returned to Honolulu for further rehabilitation.

A dead seal pup was reported by Navy personnel on the beach at Eastern island on 9 January. This was one of the female pups brought here for rehabilitation in 1992 (red tag: Z24 & Z25;

yellow tag: Z60 & Z160). The seal had a large hole across its chest, an apparent shark bite. In March, another dead seal pup (red tag Z71 & Z75) was discovered on the north beach of Eastern Island.

On 15 April seven Hawaiian monk seals accompanied by two NMFS volunteers arrived via the AMC flight. When the *Townsend Cromwell* arrived on 19 April they were loaded onto the ship and transported to Kure Island for rehabilitation. The seals will be rehabilitated at Kure rather than Midway due to the relatively high mortalities of seal pups and juveniles here in 1992. It is hoped that this project will provide useful information in detecting the cause of the Midway mortalities.

On 18 April LCDR Driggers and NMFS volunteers discovered a nursing seal pup on Spit Island. This pup was not seen again until 15 May when two pairs of pup and mother seals were observed on Eastern Island.

Three NMFS volunteers arrived on Midway 20 May to evaluate the condition of previously rehabilitated seals and tag the two seal pups. They departed on 1 July. A total of only two of the rehabilitated seals were resighted in June. One of the seal pups observed in May was tagged on Eastern Island on 21 June.

On 14 July an emaciated untagged female monk seal was reported on the beach at Frigate Point. There were no signs of injury, but it was clearly dying. LCDR Driggers recommended that the seal be euthanized. John Henderson of NMFS examined the seal, but decided not to euthanize it. The refuge staff planned to do a necropsy on it when it died, but the seal disappeared on 24 July.

On 3 June, an AMC crew member encountered a monk seal and her nursing pup on Eastern Island. The mother was disturbed by the presence of this individual and made efforts to protect the pup by charging him. Although Eastern Island has restricted access, the OIC hosted the crewman and other visitors. No legal remedies were pursued when we learned that the crewman was not briefed prior to landing on Eastern Island. The incident was not reported to the Refuge through official channels resulting in tension between the OIC and Refuge staff.

Immature and subadult threatened green sea turtles (*Chelonia mydas*) were common in Midway's waters. Adults are less common. Few turtles bask on Midway beaches, but occurrence of basking turtle have increased in recent years. There are no historic records of turtles nesting at Midway.

3. Waterfowl

Waterfowl do not regularly migrate to or overwinter on Midway. However, each year birds get blown off course or lose their way and land on Midway. Mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), American wigeon (*Anas americana*), Eurasian wigeon (*Anas penelope*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), Lesser scaup (*Aythya affinis*), common goldeneye (*Bucephala clangula*) and bufflehead (*Bucephala albeola*) were observed in protected marine waters or ephemeral ponds and catchments when freshwater levels were sufficient.

5. Shorebirds, Gulls, Terns and Allied Species

Common, nonbreeding, migratory shorebird species that overwintered at Midway were the Pacific golden plover (*Pluvialis dominica*), bristle-thighed curlew (*Numenius tahitiensis*), wandering tattler (*Heteroscelus incanus*) and ruddy turnstone (*Arenaria interpres*). Other migrants that were observed include: semi-palmated plover (*Charadrius semipalmatus*), lesser yellowlegs (*Tringa flavipes*), spotted sandpiper (*Actitis macularia*), dunlin (*Calidris alpina*), sanderling (*Calidris alba*), western sandpiper (*Calidris mauri*), sharp-tailed sandpiper (*Calidris acuminata*) pectoral sandpiper (*Calidris melanotos*).

Gray-backed Tern

The first of the season observation of gray-backs were made on and around the channel buoys on 13 March. Others were observed at Sand and Spit islands on 14 March. Approximately 70 were seen on the end of the north breakwater at the mouth of the inner harbor of Sand Island on the 14th. The first egg of the season was observed at Spit Island on 2 April. Chicks were observed at Eastern and Spit islands on 20 May. Three chicks were also observed at the breakwater on the north side of the inner harbor on Sand Island on 22 May. Adults on egg and chicks were observed at both Spit and Eastern island on 4 June. By 21 June, most chicks were stage 4-5 although eggs were still being incubated by few birds on Spit Island. Only fledglings were present by the end of July.

Sooty Tern

Sooties were observed flying overhead over Eastern Island on 5 March. By the end of that month a few hundred were observed on the ground. The first egg of the 1993 breeding season was observed on 26 April on Eastern Island. Large numbers were on egg in May. On 4 June chicks started to hatch on Eastern Island. By the end of the month numerous stage 2 chicks were observed throughout the island although adults on egg were also present. Stage 5 chicks were observed along the

periphery of the colony at Eastern Island by the end of July. Near fledging size chicks were seen in August. A few still remained in September. All chicks fledged by October.

Brown Noddy

The first laying occurred in May when two brown noddies were observed on egg at the south side of the runway near the NAVFAC buildings. Numerous adults were observed frequently at Old Taxiway, but no nests have been observed there that month. We started monitoring the Old Taxiway and NAVFAC colonies in June when most brown noddies were on egg. This colony was monitored until all chicks were capable of flight, the third week of November. A total of 22 eggs were laid at the Old Taxiway and 164 at NAVFAC. This does not represent the total nesting population on Sand Island. Eggs may have been lost between the date of first laying (May 17) and when monitoring was initiated on 13 June. Furthermore, low density habitat in naupaka (*Scaevola sericea*) and ironwoods were not monitored.



Brown noddies were monitored on Sand Island, Midway Atoll. [TM 8/93]

Stage 4 chicks were also observed in the ironwood trees at Eastern Island in July. Although there were over a hundred birds at this colony, they had been visited once during the breeding season to minimize disturbance to sooty terns.

Black Noddy

Black noddies were observed nest building in February. In March birds attempting to nest diminished. Only few birds were sitting on their nests by April. In May, large numbers of black noddies were observed sitting tightly on their nests. A stage 2 chick was observed in a nest behind the Museum on 28 June. This was the first sighting of a chick this season. Few fledging size chicks were still present by September. This species is difficult to monitor on Sand Island where they generally nest in ironwood trees that may be over 15 m high.

Few new nests were observed by the end of November. On 19 December, a newly hatched chick was found on the ground near building 423. We estimate that the egg was laid at least by 22 November.

White Tern

Numbers of breeding and incubating white terns began to increase by the end of February. By March there was an increase in chicks, but egg laying also continued. Large number of chicks were observed on Sand Island by April. In June, breeding phenology ranged from eggs to fledglings. Only stage 6 chicks were present by November. By mid-December all of the 1993 chicks had fledged. Two newly laid eggs were observed on Sand Island by the second week of December.

6. Raptors

Short-eared owls were infrequently sighted on Sand Island. In October a northern Harrier was observed on Sand Island. It was also observed several times in November and December.

7. Other Migratory Birds

Short-tailed Albatross

Both the adult and subadult individuals were present on Sand Island from the first of the year until late April. The subadult returned on 26 November and the individual in adult plumage returned on 2 November.

On 9 November, the individual in subadult plumage was discovered on egg. The egg was abandoned on 13 December. After observing this egg for a week, it was collected and replaced with an "accidental" Laysan egg. The egg was tested for viability and measured to verify that it was not incubating a Laysan or black-foot egg. The egg was not viable. The egg measured 120.0 mm x 71.5 mm. This is longer and narrower than data in the literature for this species. The subadult plumaged bird returned on 21 December where it was observed near its nest site, but did not attempt to incubate the egg we had placed in the nest.

Laysan and Black-footed Albatrosses

Midway has the world's largest colony of breeding Laysan albatrosses. A Refuge estimate of 850,000 breeding birds was made during the 1991/92 breeding season. Black-foots were estimated at 39,00 breeding birds that same breeding season. Counts during the 1992/93 breeding season at 28 counting units showed a 15.4% decrease of breeding Laysans as compared to the previous breeding season. We were unable to determine the cause of this apparent decline. No changes were observed in the black-foot numbers.



Albatross study chicks were marked with nyanzol dye.
[DAW 3/93]

The reproductive success of Laysan and Black-footed albatrosses has been monitored since the 1991/92 breeding season. Laysans had 0.84 chicks fledged/eggs hatched in 1991/92 compared to 0.95 chicks fledged/eggs hatched the following breeding season. Hatching success and productivity could not be compared since monitoring during the 1991/92 season did not begin until 9 December. During the 1992/93 breeding season black-footed albatrosses were first monitored on 13 November and Laysans on 20 November. Hatching success was 83.0% for both species during that breeding season. Laysans had 0.64 fledged chicks/egg laid and black-foots successfully fledged 0.79 chicks/egg laid. Fledged was defined as chicks that had left our study plots.



A partial albino black-footed albatross was discovered at the Fuel Farm on Sand Island. This bird successfully fledged. [MN 4/93]



This cross-billed Laysan albatross chick was one of two such birds observed on Sand Island. The chick eventually died and was collected by the SERE Group for analysis. [DAW 3/93]

Wedge-tailed Shearwater

The first sighting of wedge-tails in 1993 occurred on 2 April at Eastern Island when an individual was observed. Numbers increased by the end of that month. Wedge-tails were also present on Sand Island in April. Wedge-tails were on egg by mid-June on both Sand and Eastern islands. A number of eggs were removed at underground storage tank removal sites that required tree cutting. Also see Section F.10. Tree cutting along pipeline routes for the underground storage tank project impacted wedge-tail chicks in October, but none were sacrificed.

Christmas Shearwater

One bird was observed at Eastern Island on 26 April. By 20 May, three birds on egg were observed on Eastern. Several others were observed under naupaka bushes. A total of seventeen individuals were observed on the night of 26 July. None of the nests were followed beyond the incubation period to minimize sooty tern disturbance. However, surveys during the incubation period strongly suggest that this species is close to being eliminated at this refuge. The population decline is attributed to herbivory and predation of the black rats.

White-tailed Tropicbird

In June, a young white-tailed tropicbird (*Phaethon lepturus*) chick was discovered in a flower bed at house 422. This chick fledged in August. An incubating bird was discovered in a fork of an ironwood tree near the water tower in July. By August, this nest failed.

Red-tailed Tropicbird

Although present throughout the year on Midway, more birds began to return in January. By March most birds were incubating and a few chicks had hatched. Most of the chicks had hatched by the end of May. By October stage 9 and 10 chicks were observed on all islands of the atoll. By the end of the year only few stage 10 chicks were still present.



Midway Atoll NWR has the largest colony of red-tailed tropicbirds in the Hawaiian Islands archipelago.
[TM 9/93]

A few red-tailed tropicbirds were impacted by the site preparation activities for the removal of underground storage tanks.

Great Frigatebird

The first great frigatebird (*Fregata minor*) egg of the 1993 breeding season was observed on 19 March. The first chick of the year was seen on 20 May. On 4 June a count of 109 eggs and 21 chicks was made from the entire breeding colony on Eastern Island. By October only stage "G" and older chicks were observed.

Red-Footed Booby

Birds were present at the Eastern Island colony, but no eggs were observed in January. The first seasonal observation of birds on egg was made on 5 March. Two observers counted 148 eggs at the main colony on Eastern Island on that date. Another 26 nests of unknown status were also counted. By 26 April most of the boobies were brooding chicks. An attempt to census boobies was aborted on 4 June due to disturbance of recently hatched sooty tern chicks. By July, most chicks were near fledging size. By 27 October most chicks had fledged. Adults and juveniles were present through November and December, but no nesting activity was observed.

Masked Booby

A single roosting individual was observed on Eastern Island in January. On 26 April, two separate adults were seen on Eastern Island. One bird had a band on each leg, but no attempt was made to read the bands. On 24 May, an adult was observed on the beach at Frigate Point, Sand Island. An adult was observed on Eastern Island in June and July. Two adults were observed on Eastern Island on 27 October. Three adults were observed on 11 November.

Brown Booby

Three adult brown boobies were observed on two range markers in the middle of the atoll on 13 March. Another sighting of a single bird on one of the range markers was made on 28 March.

9. Marine Mammals

An estimated 200-250 Hawaiian spinner dolphins inhabit the marine waters of Midway Atoll. The dolphins tended to rest in the shallow waters of the lagoon during the day and foraged in deeper outside waters at night.

10. Other Resident Wildlife

Midway's only terrestrial breeding bird species were the introduced common canary (*Serinus canarius*) and common myna (*Acridotheres tristis*). In recent years, mynas have been observed depredating local gardens. Introduced rats and mice were also present on Sand Island. Mice do not occur on Eastern or Spit islands.

11. Fisheries Resources

Approximately 49 families, represented by predominantly reef fishes, are associated with Midway Atoll. Additional pelagic fish species occur in deeper waters within and outside the atoll.

In August, Tim Sutterfield, PACDIV biologist, and a team of researchers spent a week on Sand Island studying the occurrence of ciguatera on fish of Midway. Preliminary findings indicated that all fish within the reef were toxic. Kawakawa (*Euthynnus affinis*) that was caught inside the reef also contained ciguatoxin. A barracuda (*Sphyraena barracuda*) caught outside the reef also tested positive.

14. Scientific Collection

The only scientific collection to occur at Midway was of inshore (reef) fishes by staff of Bishop Museum, Honolulu, HI,

fish samples for ciguatera testing, abandoned albatross eggs and three Laysan albatrosses by James Ludwig of the SERE Group. (see also Section D.5).

15. Animal Control

Piguniq Management Corp. (base contractor) used bait stations to control rat populations in and near occupied areas of the NAF on Sand Island. While designed for the welfare of the human population, these measures benefit burrow nesting petrels and tree nesting white terns and black noddies.

There was a total of 46 bird strikes involving the two species of albatrosses. Most of the strikes occurred from January through May.

Historically, BASH was a major issue at Midway. In the 1950's and 60's this resulted in the killing of thousands of albatross. Although BASH still exists, the Navy has not requested any assistance in alleviating the problem. Aircraft traffic at Midway has been much reduced since the 1960's.

16. Marking and Banding

The SERE Group banded several thousand adult albatrosses in the fall. The Refuge banded albatrosses, Bonin petrels and brown noddies as part of our reproductive success studies. All birds rescued from site preparation activities for the underground storage tank project were banded.

Black rats were ear tagged as part of a study on the effects of rat predation on Bonin petrel reproductive success.

H. PUBLIC USE

1. General

There is no "public" access as such. The base has restricted access and base clearance must be acquired before arrival. Residents must be employed or be a spouse of an employee at the facility. Visitors are allowed for particular endeavors or, in some cases, aircraft layovers and emergency ship repairs. The population of Midway was estimated at about 180. A maximum of 7 Navy personnel were stationed at NAF Midway, by the end of the year this number had dropped to 4. The base contract work force consisted mostly of third-country Nationals from Sri Lanka, Thailand and the Philippines with U.S. citizen managers and supervisors.

Midway is supplied by a weekly Military Air Command (Air Force) C-141 cargo plane which carries passengers, mail,

perishable goods and high priority cargo. Other supplies and equipment are brought via cargo ships about every 6 months.

In January and March, Annette Campbell of the Navy Public Affairs Office and photographer Tim Bradley visited Midway to put together a piece on veterans of the Battle of Midway as well as the wildlife.

The Midway Memorial Foundation spent 3-10 June on Midway Atoll to prepare a piece on the Battle of Midway. Two veterans of Midway accompanied the group.



The Midway Memorial Foundation put together a piece on the Battle of Midway. Part of the filming was done on Eastern Island with a pilot who was stationed there during World War II. [MN 5/93]

In August, Honolulu TV station KHON TV brought their Let's Go Fishing crew here to photograph fishing activities. Reporters from KHON TV and the Honolulu Advertiser visited Midway to cover the operational base closure ceremony during the first week of October.

6. Interpretive Exhibits/Demonstrations

The Navy agreed to a wildlife orientation for incoming visitors in February. We initially attempted to make the presentations on the arriving C-141s, but moved it into the AMC waiting room after complaints from passengers. A display

of seabirds was placed at the AMC waiting room at the Hangar to provide a valuable visual aid while giving our wildlife talk. Wildlife briefings were also given to captains of visiting ships.

Navy personnel from Adak initiated R&R visits to Midway in March. Additional visits occurred in April, July and September. Between 60-70 Navy personnel arrived on each visit. The refuge staff gave nature walks to three of the four groups.



NAS Adak personnel arrive for R&R at Midway. [MN 11/93]

Due to operational base closure, we curtailed visitor center activities after October. The Refuge visitors center was open to residents and visitors whenever the staff was present in the office. We stopped presentations of wildlife video tapes and moved the equipment to our volunteer bunkhouse. We had a total of 584 visitors in 1993.

7. Other Interpretive Programs

Three Refuge entry signs were installed on Sand Island in November by George Fisher from Oahu NWR.

8. Hunting

Hunting is not allowed at NAF Midway. Firearms are prohibited.

9. Fishing

Recreational fishing is a popular activity at Midway atoll. Finfish are caught by hand line, pole and line, and throw net. Spear fishing is not allowed at NAF Midway. Because of the danger of ciguatera poisoning, the consumption of finfish caught inside the reef is forbidden. The recreational take of finfish is not otherwise regulated at Midway since it lies outside of state jurisdictional boundaries. As weather and seas allow, fishing parties use base recreational boats to troll outside the reef for pelagic fish species, such as ahi (*Thunnus alalunga*), aku (*Katsuwonus pelamis*), kawakawa and ono (*Acanthocybium solandri*).

10. Trapping

Spiny lobster (*Panulirus marginatus*) trapping and free-hand capture by snorkelers and divers were allowed at NAF Midway. Although not quantified, the take of lobsters was popular with local residents. Lobsters were considered safe for consumption. Black rat live trapping was conducted to estimate populations at Bonin petrel study sites.

11. Wildlife Observation

The ability for the public to participate in wildlife observation was limited at Midway due to the controlled access onto the military installation. In addition, visitation to the uninhabited islands was further restricted by the Officer-in-Charge (OIC) and Refuge. Island residents and visitors were able to observe nine species of seabirds nesting on the inhabited island (Sand). Monk seals and sea turtles were commonly observed on the beaches or in the nearby waters.

14. Picnicking

One picnic pavilion was located at the recreational beach on the north side of Sand Island. This site was regularly used by residents and visitors for cookouts during warm spring and summer days and evenings.

16. Other Non-Wildlife Related Recreation

Other non-wildlife recreational pursuits included softball, tennis, motor boating, snorkeling, diving, beach combing, and beach volleyball. Equipment for the above was provided at nominal charges by base recreational services. These activities were not regulated by the Refuge unless conflicts with fish or wildlife were determined to exist.

17. Law Enforcement

The case against PMC employee Don Magnon for kicking a Laysan albatross in February was dropped by the U.S. Attorney. However, through an agreement between Magnon and the OIC, 24 hours of community service was performed.

On 17 June, the Refuge staff discovered that PMC had cut a number of ironwood trees which resulted in the alleged take of seabird eggs and chicks. The project was not previously coordinated with the Refuge. It was intended as a practice for the upcoming contract to remove trees at underground storage tank sites. The Division of Law Enforcement issued the supervisor of this project a citation on 3 September 1993. This was the first enforcement action taken at the Refuge. It proved to be effective in sending a clear message that violations of wildlife laws will be pursued.

I. EQUIPMENT AND FACILITIES

5. Communications Systems

The Refuge depends on the Navy's Autovon telephone system for communications. The entire island depends on a single line and consequently the refuge had a terrible time communicating with the Complex office in Honolulu. Telephone communication was also available through the AT&T International line, but at international telephone rates.

6. Computer Systems

We have one 286 computer and a dot matrix printer. In September we received our new CompuAdd 486 computer, but it failed to boot-up. The company sent us a new motherboard, that also proved to be defective. A second motherboard had to be sent before the computer operated properly. Due to our remote location, it took two months to correct the problem.

8. Other

The Service's primary facility was the Refuge office located in the one-room NAF Museum at the Midway "Mall". It opened 23 November 1990. The office consisted of approximately 182 ft² of corner space in the museum and a separate storage room with about 112 ft². The NAF Museum was not staffed by Navy or contractor personnel. It was open to visitors only when Service staff were at the Refuge office. The museum also served as a Service visitor center with natural history displays for island residents and visitors.

The Service had a refurbished electric golf cart, a gas powered golf cart, six bicycles one four-wheeler and one tricycle for transportation on Sand Island. The Refuge also had a 16-foot inflatable Zodiac raft with a 25 hp Evinrude outboard engine for transportation between islands. The boat was stored outside on its trailer while ancillary equipment was kept in lockers located in indoor space shared with the Navy's recreational divers.

J. OTHER ITEMS

1. Cooperative Programs

The Refuge overlays an active Navy installation, thus the entire site is managed cooperatively with the military and its contractors. Refuge personnel monitor base projects, programs and situations for potential to impact fish and wildlife resources, making recommendations to avoid, reduce or otherwise mitigate impacts. Since almost all unpaved areas provide nesting habitat for some species of seabirds, most outdoor projects and activities have potential for some impact.

The Refuge received funds from the Navy's Legacy project to control rats on the refuge. A plan was developed by Animal Damage Control personnel in FY93. Actual eradication/control efforts are planned for the fall of 1994.

3. Items of Interest - Wildlife Issues

Since the 1992-93 breeding season, a cable blocking access to the bulky dump was documented to injure or kill seven albatrosses. Leinecke and Demarest took corrective action by installing old sono buoy cases over the cable. Since its placement, no albatross injury or deaths has occurred. The refuge has worked on this hazard since the cable was first installed during the summer of 1992. Fishing buoys were initially strung on the cables, but most of them broke loose through the winter. The sono buoys are more visible and should remain in place in spite of wind storms.

A vault in the fuel farm that was a trap for Bonin petrels was filled with sand by Piquiniq Management Corporation in April. The contractor responded to requests by the Navy and Refuge staff. Elimination of bird traps has been an ongoing effort among Piquiniq, the Navy and the Refuge for the past year.

A vault across the road from the Seabee hangar that was a trap for Bonin petrels was filled with sand by Piquiniq.

On 10 May, crushed burrows were observed in one of the Bonin petrel study plots. The affected areas were on opposite sides of a road and appeared to be caused by a large lawn mower. This incident resulted in the death of one Bonin chick. Navy personnel inspected the area, but no further investigation was conducted.

Projects to remove *Verbesina* in the living areas of Sand Island by pulling them out by the roots collapses Bonin petrel burrows. The refuge recommended that these weeds be cut rather than pulled and only low density areas be cleared during the petrel breeding season. By summer bush wackers were used to partially alleviate the problem and clearing was delayed in some areas. However, on 24 June workers had cleared an area right where a red-tailed tropicbird was incubating an egg and another site where a chick was present. A-frames were placed around both nests, unfortunately, the incubating bird abandoned its nest.

In June, while burning trash at the dump, a strong gust caused the fire to jump a trench and burn the adjacent brush. A number of albatross chicks were present and one was burned on its rump, wing and head. The contractor immediately notified the Refuge staff, but the chick died the next day. To prevent future brush fires, fire breaks were constructed adjacent to trenches used to burn trash.

An individual working under the Waikiki Aquarium's Special Use Permit scared a partial albino black-foot over a beach embankment while attempting to photograph it. A visit to Eastern Island was also made in June. The permit allowed photography of fish and marine invertebrates, but did not authorize wildlife photography. Our wildlife orientation to all incoming visitors informed them that Eastern Island is off limits. The permit was amended immediately to establish a minimum photographic distance. It also specifically prohibited visits to Eastern and Spit Islands.

4. Credits

This narrative was written by Mike Nishimoto and reviewed by Duane K. McDermond.

photos:

DKM	Duane K. McDermond, FWS
DAW	Don A. Williamson, FWS
KT	Karen Tanaka, FWS
MN	Mike Nishimoto, FWS
TM	Terry Moore, FWS

K. FEEDBACK

Refuge Fact Sheet

Revision Date: April 1993

Refuge: Midway Atoll National Wildlife Refuge

Date Established: April 1988

Acreage: 90,097 total: 1,549 emerged and 88,548 submerged

Legislative District: Not included under the jurisdictional authority of any state or territory

Location: Midway Atoll is located approximately 1,150 miles northwest of Honolulu. The address of the on site office is:
P.O. Box 1
Midway Atoll
FPO AP 96516

Staffing: Refuge Manager
Wildlife Biologist

Additional staffing is provided out of the Pacific Remote Islands NWR Complex Office, Honolulu, Hawaii.

Purpose:

"...for the development, advancement, management, conservation and protection of fish and wildlife resources..." 16 U.S.C. 742 f(a)(4) "... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive of affirmative covenant, or condition of servitude..." 16 U.S.C. 742 f(b)(1) (Fish and Wildlife Act of 1956).
"...shall be administered by him [Secretary of the Interior] directly in accordance with cooperative agreements... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon..." 16 U.S.C. 664 (Fish and Wildlife Coordination Act).

Land Status:

The Refuge was established under a cooperative agreement with the U.S. Navy. Administrative responsibility for this Refuge is shared by the U.S. Navy and the Service. Operational control of the Refuge will be by the Navy. The Service manages marine and wildlife resources.

Goals:

A natural resource management plan has been completed by the Service for the Navy and is the guiding document for management of the Refuge. The Refuge is managed primarily as nesting, roosting, and loafing habitat for seabirds, shorebirds and endangered species. Military activities and natural resource uses are regulated and monitored to minimize adverse impacts on terrestrial and marine wildlife and habitat.

Landscape Characteristics:

The islands of Midway Atoll provide terrestrial habitat for monk seals and green turtles, and nesting space for nearly a half-million seabirds of 15 species. Fish and wildlife resources have been impacted by the long history of human occupation. Human disturbance has radically diminished seal populations and affected turtle use of the islands for basking and nesting. Conversion of seabird nesting habitat for runway development and housing; introduction of exotic plants, rats, birds, and insects; placement of antennas and lights; and direct control to reduce bird aircraft strike hazards have all impacted wildlife populations. Maintenance of island facilities continue to conflict with wildlife on the islands.

Public Use:

The Navy controls general public use. The Service permits wildlife-oriented public use by researchers, film makers, photographers, and journalists. Navy operations are currently scaling down. The permanent human population is around 200 civilian and military personnel. Occasionally, the population rises above this when vessels or aircraft visit. These personnel come in close contact with resident wildlife, often resulting in human/wildlife conflicts, especially related to endangered species (monk seals) as well as albatross and burrowing seabirds.

Issues/Needs:

1. Staffing of overlay Refuge.
2. Interpretation and education for Midway personnel and visitors.
3. Endangered species monitoring.
4. Migratory bird monitoring.
5. Monitoring effects of disease, contaminants, and rat effects on wildlife resources.
6. Technical assistance to Navy to ensure construction/maintenance projects are planned to have minimum impact on wildlife resources.
7. Rat control/eradication.
8. Debris/contaminant cleanup.
 - a. Eastern Island antennas, runways, buildings.
 - b. Underground and above ground storage tanks on both islands.
 - c. Other hazardous contaminants yet to be identified.
9. Base closure and required restoration and Refuge status.
10. Taking of migratory birds due to military operations.
11. Development of effective agreements to ensure year-to-year Service-Navy cooperation and accountability.