FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2005
(Combined with 2004)

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

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Refuge Manager — November 25, 2006 — Date

Refuge Complex Manager — December 5, 2006 — Date

INTRODUCTION

Farallon National Wildlife Refuge was established in 1909 and is located approximately 28 miles west of San Francisco. It is comprised of four groups of islands including the North Farallons, Middle Farallons, and Noonday Rock which are all designated as wilderness areas. The South Farallon Islands were given refuge status in 1969 and are the largest group consisting of 120 acres and reaching a height of 370 feet. West End, a portion of the South Farallon Islands, is also designated a wilderness area. The Refuge totals 211 acres.

The Refuge comprises the largest continental seabird breeding colony south of Alaska. It supports 13 nesting species including the world's largest breeding colonies of ashy storm-petrel, Brandt's cormorant, and western gull. Six pinniped species also breed or haul out on the Refuge. After absences of over 100 years, northern elephant seals and northern fur seals returned to breed on South Farallon Islands in 1972 and 1996, respectively.

The Farallon Islands are a granitic formation that is part of the Farallon Ridge. Shallow soils can be found scattered on some of the South Farallon Islands. Vegetation is dominated by Farallon weed, an important nest building material for cormorants and gulls. Floral diversity is limited and is made up of a high proportion and number of nonnative species due to the large amount of human activity on the Southeast Farallon Island (part of the South Farallon Islands) since the 1800's.

Wildlife populations were heavily exploited in the late 18th and early 19th centuries for meat, hides and eggs. Over-fishing of sardines reduced seabird food supplies. Some species were extirpated or declined drastically. Historical estimates indicate that thousands of northern fur seals and as many as 400,000 common murres once populated the islands. An active Coast Guard station further impacted island wildlife and habitat until the full automation of the light station in 1972. Under Refuge stewardship, extirpated species have re-colonized the islands, and wildlife populations as a whole are slowly recovering. Still, wildlife remain vulnerable to the impacts of pollution, oil spills, gill net fisheries and global climate charges. The Service has cooperative agreements with Point Reyes Bird Observatory and the U.S. Coast Guard to facilitate protection and management of the Refuge

TABLE OF CONTENTS

H. PUBLIC USE

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

- Three burrowing owls, confirmed as ashy-storm petrel serial killers, were successfully captured and moved to Warm Springs on the Don Edwards NWR (Section G. 6).
- The Refuge was in the limelight following an on-island tour for a group of journalists in May and Congressional interest in opening the Refuge to public use in (Section H.1 and 7)
- A state-of-the-art septic system was installed, eliminating all wastewater discharge and allowing us to bid farewell to the composting toilet (Section I.1).
- A real phone system and high speed internet were installed (Section I.2).

B. CLIMATE CONDITIONS

Temperatures are relatively constant throughout the year, seldom falling below 45°F or rising above 65°F. Most rainfall occurs in the winter. Summer moisture is usually limited to damp fog. Offshore fog banks frequently envelop the islands in dense fog.

The most notable weather event during 2005 was the warm and rainy weather pattern which persisted through June. May was probably the rainiest in Farallon history, with 3.45" of rain. Even more unusual was the 1" of rain that fell in June. Sea surface temperatures (SSTs) in the early part of the seabird breeding season were above average, and there was little upwelling and light winds in May, producing El Niño-like conditions. These oceanic conditions resulted in poor productivity. Trawls by the National Marine Fisheries Service in June caught no rockfish, and fishermen noted an absence of krill and salmon near the island. The lack of food early in the season negatively affected seabird productivity. SSTs and wind patterns were more normal later in the season, but too late apparently to turn the seabird situation around (see Section G.5).

D. PLANNING

1. Master Plan

Preparation of the Farallon NWR Comprehensive Conservation Plan (CCP) was initiated in 2005 by Refuge Planner, Winnie Chan and her Planning Core Team consisting of Refuge Manager Joelle Buffa, Farallon ROS Jesse Irwin, Murre Project Leader Gerry McChesney, PRBO Biologist Russ Bradley, and Patricia Duff (US Coast Guard). The first public scoping meeting was held on May 25 in San Francisco. Staff out-numbered the public, as is typical for these types of events.

5. Research and Investigation

Farallon NWR is managed by the Fish and Wildlife Service out of the Refuge complex Headquarters. We hold a cooperative agreement with the Point Reyes Bird Observatory (PRBO) for their biologists to be present on the island year-round. They monitor seabirds to determine

breeding population size and productivity for 11 species of nesting seabirds, and census number of adult and pups of the 5 species of marine mammals that haul out on the Refuge. PRBO also provides day-to-day resource protection, preventative maintenance, and conducts research approved by the Refuge. The Service provides funding, direction, maintenance support and some assistance for studies.

PRBO studies were numerous, some of which are long term projects that have been on going since the 1970's. They included:

Population demography of the western gull: This study examines survival, breeding biology, and breeding site fidelity in relation to life history traits, reproductive life span, and performance. Monitoring known-age gulls provides the core of this project. The oldest known western gull in the world was discovered on the Refuge this year. Known by its ID number as J73-04, it was banded on Southeast Farallon Island (SEFI) in 1973, when Nixon was in the White House, the Watergate scandal raged, and "American Grafitti" was the must see movie. At 32 years old and still breeding, it is older than most of the biologists on the island.

Demography, population dynamics, and food habits of common murre: Four study plots (Shubrick, Upper Upper, Cliff, and Tower) are monitored daily during the breeding season to determine number/location of breeding sites, phenology, breeding success, incubation, and chick-rearing periods. Intensive observations are made of parental care, chick diet, feeding intervals, and foraging trip duration. Diurnal attendance is determined by conducting 3 all-day censuses. Studies of the fish adults feed to chicks have shown that northern anchovy, sardines, and juvenile rockfish are the most important provisioning items. The consumption of juvenile rockfish dominated in the 1970s and 80s, while anchovy and Pacific sardine dominated in the 1990s. Between 2001 and 2003 juvenile rockfish were again predominant in the chick diet, but comprised only a minor part of the diet during 2005.

Common murre banding and diet study: After completing a compatibility determination, the Refuge granted permission for PRBO seabird biologist Pete Warzybok to collect diet samples from adult common murres in order to develop a year-long prey consumption model. The work is part of Pete' graduate work at Humboldt State University. During two capture sessions (February and March 2005) 276 murres were captured and processed from the Upper Shubrick plot using a knock-down net and pulley system. Processing consisted of individually color-banding (and metal banding) each bird, and collecting stomach contents from 30 birds (see G. 5 &16).

Demography, population dynamics, and food habits of Brandt's cormorants: The colony at the Farallons represents the largest single known Brandt's cormorant colony anywhere. Breeding/ productivity studies are conducted at Upper Shubrick and Corm Blind Hill. Reproductive success of known-age birds is being investigated to determine parameters such as age at maturity, fecundity, longevity, mate/site fidelity, survival to breeding age, and how these relate to breeding effort and success. A diet study, initiated in 1983, has shown that midshipman are the most important group in terms of mass, comprising over 50% of the identified diet, although rockfish are the most abundant species-group recorded.

Demography, population dynamics, foraging ecology and diet of pigeon guillemots: Survivorship and parental care is studied by observing color banded birds. Diet watches are conducted at known sites. Observers record site number, band markings, time, and the prey species being taken to breeding sites. Guillemot diet has tracked a pattern similar to murres. Juvenile rockfish are the predominant food item fed to chicks in years when they are available (e.g., 1970s, 1980s and 2001-2004). During the 90s and in 2005 sculpin and flatfish were most predominant in chick diet.

Demography, population and diet of rhinoceros auklets: A mark/recapture study was begun in 1987. As of 2005, 826 birds had been banded and previously marked birds had been recaptured 1025 times. The objectives of this study are to more accurately determine population size, although data has not yet been analyzed. Birds are mist-netted at four sites, and food items carried in by netted birds are collected and identified. Rhinoceros auklet chick diet shows more variability and less of a pattern than that of murres and guillemots. In 2005, anchovy and saury were the predominant food items. Occupancy rates and productivity are studied at nesting boxes and natural crevices/burrows.

Demography, population dynamics, and food habits of Cassin's auklets: Age specific reproductive performance and survival, lifetime reproductive success, and recruitment patterns of Cassin's auklets are studied by banding birds and monitoring known-age individuals nesting in artificial nest boxes. Regurgitations are collected to determine food items brought back to chicks. Analysis of diet items since 1994 show krill *(Thysanoessa spinifera* and *Euphausia pacifica)* to be the main food items.

Colony Formation in Cassin's auklet: This study was initiated in 1990 to investigate the impacts of western gull predation on Cassin's auklets. Specifically, it addresses the question of whether gulls prevent auklets from colonizing areas which have previously supported high densities of nest burrows. Ten 100 square meter plots are monitored during peak incubation. Occupancy rates of natural burrows in index plots are determined by using a burrow camera.

Population status and productivity of ashy storm-petrel: A mark-recapture study using mist netting, initiated in 1992, continued for the 14th year. Petrels are mist netted and banded at two locations on two nights/month (April through August), weather permitting, to determine population size and assess population trends. To date 4861 ashy storm-petrels (ASSP) have been newly banded (549 of these in 2005) and previously marked birds have been recaptured 879 times (104 recaptured in 2005). 2005 was the 4th consecutive season that a record was set for single night captures; 168 ashy storm-petrels captured on May 25 beat the July 6, 2004 record of 158 captured . Leach's storm-petrels are also banded in this study. Productivity of ashy storm-petrels is monitored at known natural crevice nesting sites.

Ashy storm-petrel predation monitoring: Standardized collection of ASSP wings along the Lighthouse Hill Path (LHH) and collection of owl pellets from known roosting sites were continued. These studies were initiated several years ago to quantify predation by western gulls and burrowing owls. Monitoring of nest boxes and natural crevices for signs of mouse predation were discontinued because results have been inconclusive.

Tufted Puffin: Breeding population estimates are made by conducting daily observations during a week-long period in mid-May and another one in early August. Puffins breed in inaccessible rock crevices on the Refuge, and whether or not a known breeding site is active in a particular year is determined from observed behaviors of the birds (e.g., a pair seen at the entrance, a bird entering the crevice with nesting material or fish).

Black Oystercatcher: Historic nesting sites are monitored.

Reproductive ecology and survival of the northern elephant seal: Multiple objectives focus on the effects of age on reproductive success and the effects of white shark predation on juvenile elephant seal survival. Methods included tagging, marking, and censusing elephant seals during the winter breeding season (Section G.9). Studies have been conducted annually since the Farallons were re-colonized by breeding seals in 1972. A new study, which weighs weaned pups to determine condition, was piloted in 2004 and initiated in 2005.

Biology of the White Shark at Southeast Farallon Island (SEFI): This study is being conducted in the waters around the Farallon NWR using the Refuge as an observation point. During fall months (September 1 to November 30) observers conduct all day watches from Lighthouse Hill, collecting data on shark attacks on pinnipeds, and identifying individual sharks by distinctive markings, when possible. Objectives of the study include: 1) determine frequency of predatory attack; 2) determine the species and size/age composition of white shark prey; and 3) re-sight known individuals using scar patterns. A satellite tagging component, which tracked shark movements beginning in 1999 and was phased out in 2004.

The Fish and Wildlife Service conducted the following studies:

Aerial census of murre colonies - The annual breeding season aerial photographic survey of Farallon colonies took place on June 10, 2005. Colonies are photographed using a 35mm camera, with 300mm lens, shooting out of the bottom of a twin-engine Partanavia airplane. Photographs are taken at an altitude of 800' - 1,000' above the colony. Slides are projected onto white paper and each bird is marked (or "dotted") with a felt pen, and summed for each colony. The Apex-Houston Trustee Council funds this study.

Aerial census of cormorant colonies- The Refuge cooperated with Humboldt State University and Region 1 Office of Migratory Birds (who provided funding) to conduct an aerial survey of all coastal Brandt's and double-crested cormorant colonies. Images (35 mm slides) were taken at the same time, using methodology as described for the aerial murre census. Raw nests were counted and used to derive nest counts for all colonies in the state (including the Farallon Islands), and a total state population estimate.

House Mouse population dynamics: A study to document the population cycle of house mice (*Mus musculus*) on SEFI was conducted March 2001 through March 2004. Four transects, each consisting of seven trapping sites, were established in various habitat types around the accessible

portions of SEFI. Results have been summarized in a manuscript, which has not yet been accepted for publication, and are discussed in Section G. 15.

Boardwalk burrow study: A 5-year study, initiated in 2001, of Cassin's auklets colonizing newly created/protected habitat around SEFI buildings continued. Objectives are to quantify the number of auklets nesting under 812 feet of boardwalks, which were constructed in September 2000, and compare burrow density to natural sites. Of particular interest is whether the "auklet friendly" design - gaps between boards to permit auklet passages - encourages nesting. A 5-year summary report was prepared in 2005 and is discussed in Section F.6.

The Refuge occasionally issues permits to other researchers to conduct studies. During 2004 and 2005 these included:

Intertidal communities within Gulf of the Farallones National Marine Sanctuary (GFNMS):
In 1992 GFNMS biologists began monitoring the density and diversity of intertidal species (invertebrates and algae) at six locations on Southeast Farallon Island. Point and photo quadrants are visited three times annually (February, August, November). The purpose is to develop baseline species inventory and assess natural changes over time to determine resource risk and damage assessment in the event of an oil spill or other human-induced natural disaster. In 2004 and 2005 the GFNMS added components to integrate the Farallon monitoring with a large-scale research project called the PISCO Coastal Biodiversity Survey Program. The goals of the PISCO study include: 1) Assessing long -term influences such as climate change and coastal development on intertidal communities, and 2) Examining patterns of biogeography.

Study of seabird obligate tick-born virus:
In August 2004, British researcher Mike Harris visited the Refuge for one week to collect ticks from the Shubrick murre colony as part of a global study to understand the molecular evolution of a virus that infects seabirds in the natural environment. Approximately 1,400 ticks were collected from the ground by turning over small rocks after murres and cormorants had left the breeding colony. Test results are not yet complete, but the ticks tested so far show that the virus infection prevalence is much lower (2.5%) than sites in Europe (which average 10%).

Genetic variation study of western, yellow-footed and glaucous-winged gulls: Blood samples were collected from 30 Farallon western gulls as part of a study by UC graduate student Carolina Pickens.

E. ADMINISTRATION

1. Personnel

Farallon personnel changes were mercifully few in 2004 and 2005. PRBO Conservation Science biologists, Derek Lee and Russ Bradley/Pete Warzybok continued to rule during the winter and spring/summer seasons, respectively. Adam Brown took a sabbatical during the fall to be with the young of the year Cadence Brown, and Brent Hartl filled in the fall season.

Jesse Irwin set a Farallon ROS longevity record working on his 3rd year, and Joelle Buffa is starting her 10th year as Refuge Manager. Marge Kolar was replaced by Mendel Stewart as Project Leader for the Refuge Complex in June. Marge still continues to be entertained by Farallon matters in her new position as Assistant Manager of Operations for the California-Nevada Office, since she supervises Mendel. Bill Sydeman turned over his role as Farallon Program Manager to Russ Bradley, but continues to be involved in Farallon matters, even celebrating his birthday on the Island!

Mendel Stewart gives Bill Sydeman a birthday cake

4. Volunteer Program

During 2005, approximately 25 volunteers donated about 11,400 hours of service to activities supervised by PRBO on Southeast Farallon Island. Volunteers assumed a variety of responsibilities including assisting with bird, mammal, and white shark monitoring; research; collecting meteorological and oceanographic data; and performing facility and equipment maintenance.

Volunteer Gerry Ellis re-building pump house

Major volunteer projects during 2004 and 2005 included demolition and re-construction of the murre blind and cormorant blind, re-building the pump house, and re-roofing the North Landing boat house. Volunteers Charles and Chris Whitefield, Jerry Ellis, and Tim Kask. contributed their carpentry skills. PRBO biologists Pete Warzybok and Russ Bradley designed, supervised and coordinated the blind projects. Chris Duba, skipper of the Silver Fox, donated his boat to take out supplies for the murre blind and roofing projects in conjunction with an Oceanic Society trip in August (see H.7).

Four Refuge volunteers (Brian O'Neill, Jerry Ellis, Pat Schuch and Victoria Wikle) donated approximately 192 hours during 2005, conducting non-native plant control activities. Long-time volunteer Malcolm Coulter volunteered approximately 120 hours to survey plants, which he has been conducting every three years since 1968.

Other volunteers donated a combined total of 75 hours driving Refuge staff back and forth to the boat docks and Coast Guard Air Station, and packaging/ unloading materials. A grand total of 11,795 volunteer hours were contributed by PRBO and Refuge volunteers.

5. Funding

The cooperative agreement between the Refuge and PRBO provides PRBO with an amount equivalent of one GS-7 and one GS-9, plus benefits (20%), and camp rate per diem for two persons. A total of $103,362 and $103,106 was paid to PRBO in 2004 and 2005, respectively.

The Refuge received $372,063 of deferred maintenance (MMS) project funds to complete the North Landing boat landing and safety improvements in 2004, and roughly $99,900 in 2005 to replace the composting toilet with a septic waste treatment system in 2005 (Section I.3).

The Cape Mohican Trustee Council increased the annual funding allocation for non-native plant control to $37,296 to account for salary increases and a 10% Regional Office overhead. This, together with continued funding from the Apex-Houston Trustee Council for boardwalk monitoring ($5,040), Storm Relief carry-over dollars from 1998 (exhausted in 2004) and some station funds covered Farallon ROS salary during 2004 and 2005.

FWS Coastal Estuary Program funds provided $2,000 during 2004 to purchase a burrow camera probe for the Cassin's auklet boardwalk monitoring study, and $13,300 during 2005 to expand the Pacifica marine education program to include seabirds and mammals of the Farallons (Section H.2).

6. Safety

Major safety improvements were made to the North Landing during late 2004/early 2005 by North Coast Divers (NCD) contractors. A mechanical (hand-operated) jib crane was installed to lift an unmanned Zodiac into and out of the water. A platform of non-skid fibergrate was built around the crane to cover the uneven concrete, and this operator's platform is encircled by a sturdy railing at the water's edge. Modifications were made to the boat house to accommodate the new 15' Zodiac and

25hp motor, which has a rated lifting harness. The old slippery wooden stairs were demolished and replaced with non-slip stairs and handrails made of a corrosive-proof fibergrate material. Three horizontal, stair-stepped sections of non-skid fibergrate decking were secured on top of the slippery rocks at the water's edge to provide secure footing for loading of passengers and gear into the Zodiac. Landings can now be accomplished more safely and at a wider range of tidal conditions. Boat and motor no longer have to be carried down slippery stairs, and the jib crane allowed us to purchase a larger boat that increases the safety margin for shuttling passengers and gear from the North Landing buoy.

Safety improvements continue to be made at East Landing. The derrick received its annual inspection and load testing in March 2005 by AC3. Another contractor (Nautical Engineers - NEI) performed annual maintenance, including extensive de-rusting and painting of corroded spots and an electrical inspection in September 2004. Three new stainless steel sheaves with polymer bearings and stainless pins, and a new hook assembly for the Johnson Block were installed by NEI in December 2004.

Complex Safety Officer Barry Tarbet conducted a safety review in December 2004; Derek Lee and Jesse Irwin worked to correct the deficiencies he found over the ensuing few months. A new set of freshly charged fire extinguishers were brought out in March of each year and the ones on the island brought back to the mainland for recharging.

The passive, in situ clean-up of contaminated soils behind the Powerhouse continued through 2005. Geo Engineers installed 3 additional turbines in January 2004 to augment the 5 that were installed in October 2002. Soil samples are periodically collected by Refuge staff and sent to the contractor so they can monitor the rate of petroleum dissipation.

F. HABITAT MANAGEMENT

1. General

The Refuge consists of 211 acres of mostly rocky habitats. SEFI, where all facilities and staff are located, supports a soil-covered marine terrace. The Farallon plant list includes 90 species, but only 25 of these are native. Rocky habitats provide nesting areas for many seabird species including common murres, pigeon guillemots, and Brandt's cormorants. Soils provide habitat for burrow-nesting species such as Cassin's and rhinoceros auklets. Rocky habitats are largely undisturbed. However, habitats which can support plant life on SEFI have been significantly

impacted by a history of human occupation and disturbance. Many exotic plant species flourish on the island, and in some areas have displaced the native endemic Farallon weed (*Lasthenia maritima*).

3. Forests

The "woodland habitat" on SEFI consists of three Monterey cypress and one low-growing Monterey pine, which are able to tolerate the strong prevailing winds. These small trees serve as veritable magnets to migrant land-birds. During the spring and fall large numbers of migrants can be found in and around these trees, thus facilitating censusing and banding of these birds.

6. Other Habitats

In 2000, a "Habitat Sculpture" containing 32 nesting boxes and an observation blind, was constructed near North Landing by Meadowsweet Dairy. Concrete blocks were stacked upon one another in an design engineered to create habitat for crevice nesting birds. The habitat was an immediate success at attracting nesting birds as illustrated in the chart below. The number of Cassin's Auklet (CAAU) pairs nesting in the habitat sculpture increased each year, except 2005, which was the worst year in Farallon history for this species (Section G.5)

# nest prs.	2001	2002	2003	2004	2005
CAAU	9	12	16	19	1
PIGU	0	1	1	1	1

In September 2000, 812 feet of boardwalks were constructed in heavily traveled areas around the houses and monitoring sites at the base of Lighthouse Hill to protect and enhance habitat for nesting auklets. The boardwalks were constructed to allow auklets access for digging nesting burrows underneath and adjacent to the walkways. Five years of monitoring burrow density and occupancy rate has shown that boardwalks with the "auklet trough" design were successful in expanding habitat for Cassin's auklets. The number of nesting burrows in areas influenced by the boadwalks increased steadily from 52 in 2001 to 138 in 2004. The boardwalk burrow occupancy rate was 67.4%, which is slightly above the occupancy rate of 60-65% in PRBO monitored index plots. Boardwalks were constructed in three of PRBO's index plots (S4, S5 and S7). Spatial analysis of burrows in these index plots shows that auklets select areas near or under the boardwalk for burrow placement, not surprising since auklets like to dig around rocks and manmade structures. Though the boadwalks occupied only 11% of the area in the three index plots, 44.4% of the burrows in those plots were found in the boardwalk zone of influence.

10. Pest Control

FWS personnel, PRBO and a handful of volunteers continued to control exotic vegetation, primarily New Zealand spinach (*Tetragonia tetragonioides*) and cheeseweed (*Malva spp.*), to prevent its encroachment into new areas and reduce its spread in already-infested areas where it

covers seabird nesting burrows. August 12-18, 2005 marked the 17th year in a row that Refuge staff chemically treated spinach and *Malva spp.* with a 4% Round-up herbicide solution after the seabird breeding season.

Team Spinach 2005: Jesse Irwin, Diane Kodama Joelle Buffa, Robert Stump

The 2005 infestation of spinach and Malva increased dramatically from 2004. The amount of chemical used in 2005 was similar to 2003 but at least doubled the amount of 2001, 2002, and 2004. The amount of herbicide needed in 2005 was 303% that of 2004 as a result. Average chemical usage for the 5 year period 2001-2005 was 225.8 gallons and required 68.5 hours to apply. The chart below illustrates the herbicide used since 2001. One gallon of herbicide requires an average of 3.3 hours to apply with a range of 2.07-3.64 hours/gallon. Weather patterns that produced late season rain and the absence of a Farallon ROS for much of the year are suspected culprits for the abundance of weeds on the island in 2003. 2004 saw the lowest amount of herbicide needed in many years, however the 2005 rain season continued well into June producing a bumper of weeds. Malva in particular formed homogenous stands and reached heights of over 7'.

Year	Gallons (4% Round-Up)	Hours
2001	179	52
2002	163	46
2003	313	90.5
2004	116	56
2005	388	98.25

In addition to Team Spinach, Refuge staff and volunteers spent 112 hours pulling spinach and Malva and 47.5 gallons of glyphosate was sprayed by the ROS in fall/winter 2004. In 2005, 164 hours was spent pulling weeds and 150 gallons of glyphosate was applied in addition to Team Spinach 2005. 2005 was a banner year for weeds as a total of 538 gallons of glyphosate was applied and 262 hours were spent controlling non-native plants. PRBO also contributed by pulling weeds as time allowed.

The weed management plan was completed in February 2004 and continues be updated as new control methods are explored. to address the various weeds. In addition to spinach and *Malva*, plantain (*Plantago coronopsus*) and grasses (multiple species) are major weeds degrading habitat. Seed collection of Farallon weed (*Lasthenia maritima*) was initiated to help suppress invasives in areas mechanically cleared of weeds.

12. Wilderness and Special Areas

In 1973, Middle Farallon Island, North Farallon Islands, West End (part of the South Farallons), and Noonday Rock were designated a National Wilderness Area. The largest island, Southeast Farallon, was excluded from this designation because of the structures and people living on the island. The Wilderness Area encompasses 141 acres, which serve as marine bird and mammal breeding areas. Periodic monitoring from offshore by boat or by foot is the only management practiced on these islands, therefore the wilderness designation does not affect Refuge operations, and visa versa.

The waters surrounding the Refuge are part of the Gulf of the Farallones National Marine Sanctuary, managed by NOAA. The islands and surrounding waters are designated by the state as the Farallon Islands Game Refuge, and are part of the Golden Gate Biosphere Reserve. The Farallon Islands have been designated as a Globally Important Bird Area by the American Bird Conservancy.

G. WILDLIFE

2. Endangered and/or Threatened Species

Table 1. Peak monthly population estimates of California brown pelicans on S Farallon Island

Month	1997	1998	1999	2000	2001	2002	2003	2004	2005
January	475	1000	700*	200*	1050	50*	237	3	1234
February	38	525	500*	6	20*	1*	100*	1	260
March	0	213	0	65	83	0*	158	0*	78
April	1	180	0	26	34	6	0	16	27
May	40	455	26*	42	48	9	24	19	165
June	386	1245	41	436	118	5	48	24	225
July	112	300*	300*	300*	238	181	24	190	600
August	960	810	500*	300*	307	143	160	1200	960
September	3380	2332	728*	1700	970	445*	680	2500	910
October	4350	2625	2700	2450	1350	925	1375	1900	1376
November	3030	2360	1900	663	800	1200	1140	1415	1027
December	1500	750*	1000*	650	500	500	916	682	911

*** =Average monthly population** **N/A= Data not available**

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

a. California Brown Pelican

Brown pelican numbers during 2005 peaked at 1376 in October (Table 1), which is typical. The timing of the peak was typical, as pelican use is usually concentrated in the fall and winter when birds commonly roost on the islands after dispersing from breeding sites in Southern and Baja California. Year to year fluctuations in numbers are related to water temperature (more pelicans during warm-water years), and the relative abundance of food resources in coastal and offshore zones. The unusually high numbers observed during the early part of 2005 may be due to the exceptionally high numbers that nested on Anacapa Island during the 2004 breeding season. During late 2004 and early 2005, high numbers of wintering pelicans and birds in unusual places were reported at other areas along the coast, including Humboldt Bay.

b. Steller Sea Lion

The Steller sea lion was listed as federally threatened in 1990 due to a 50% worldwide decline between the 1960s and 1989. The South Farallon Island (SFI) rookery and waters around the Refuge are designated critical habitat. Most of the following is based on Hastings and Sydeman (2002).

Counts of Steller sea lions on the Farallon Islands have been conducted since 1927, however standardized annual counts on SFI have occurred only since 1973. The Steller sea lion population has declined on SFI between the 1920s and the present. However, the magnitude and pattern of the decline is complicated by differing census techniques and differing patterns in seasonal trends, age-classes and sexes. The total count of Steller sea lions on the Farallon Islands has declined approximately 80%, from an average of 790 animals from 1927-1947, to an average of 150 animals from 1974-1997. This may be biased because animals on North Farallon Islands were not included in surveys since 1950.

Between 1974 and 1996, numbers of adult females during the breeding season declined approximately 6% per year and maximum pup counts also declined significantly. During this same period, numbers of sub-adult males increased during the breeding season, and numbers of immatures present during the late fall/early winter increased by approximately 5% per year.

A shift in pupping areas on the SFI occurred from 1973 to 1988. From 1973 to 1975 all full-term pups were born on Saddle Rock. From 1976 to 1983 females pupped in Sea Lion Cove, but this site was abandoned in the late 1980's, possibly due to increased diving activity. Pupping was first observed on West End in 1985. Shell Beach and Indian Head on West End are currently the only active rookery sites on SFI.

Steller sea lion natality rates have also declined steadily between 1973 and 1994, exhibiting a low pregnancy rate and high incidence of premature pupping (stillbirths). The premature pupping rate on SFI (30-50%) is extremely high compared to others rookeries (e.g. 2% at Año Nuevo). Twenty to thirty pups were born annually in the late 1970s and early 1980s, compared with an average of five to ten per year in recent times (Table 3). Although pup production may be somewhat underestimated because rookeries are not easily observed from island vantage points, low pup production is evident-only 11% of females give birth on average. With such low reproduction, the status of the Steller sea lions at Farallon NWR remains precarious.

Possible reasons for the SFI Steller sea lion population decline include pollution, human disturbance, over-fishing, increased disease and/or predation on sea lions, and El Niño effects. PRBO's annual monitoring suggests that the 1982-83 El Niño may have affected the number of viable pups cows were able to produce. Studies of possible causes of premature births found that five to seven premature pups sampled died of the influenza virus, and a pollution study found elevated organochlorine and trace metal (Hg and Cu) levels in sea lion tissues. It has been suggested that there may be an interrelationship between increased levels of organochlorines and PCBs and diseases.

3. Waterfowl

Waterfowl are not common on SEFI. Most records consist of duck or goose flocks flying by the island. The Refuge's most treasured fowl is Molly, a black brant that has been a resident on SEFI since 1993. We try not to remind her that she's a goose, as she thinks of herself as one of the western gull gang that she hangs out with on the marine terrace. Molly disappears occasionally for months at a time, including a 3-month disappearance in spring 2004. Where she goes remains an un-solved Farallon mystery.

4. Marsh and Waterbirds

No marsh or waterbirds breed on the Refuge, however PRBO counts wintering and migratory species daily. Black turnstones, willets, whimbrils, and wandering tattlers are commonly seen. Occasionally, rareties show up in fall or spring.

5. Gulls, Terns and Allied Species (Seabirds)

Farallon NWR is an extremely important breeding site for seabirds. It contains nearly 30% of the breeding seabird population in California and is the single largest seabird breeding colony in the continuous United States. The Refuge supports a significant proportion of state's breeding population for 10 species: Leach's storm petrel (11%), ashy storm-petrel (55%), double crested cormorants (11%), Brandt's cormorant (25%), western gull (36%), common murre (19%), pigeon guillemot (12%), Cassin's auklet (68%), rhinoceros auklet (29%), and tufted puffin (25%). The Refuge hosts the world's largest colonies of ashy storm petrel, Brandt's cormorants and western gull, as well as the most southerly colonies of significant size for rhinoceros auklets and tufted puffins on the west coast of North America.

Seabird breeding activities on the Farallon Islands are correlated with the seasonal occurrence of oceanic upwelling off central California. Extended periods of strong northwesterly winds during late winter and early spring promote the upwelling of cold, nutrient-rich subsurface waters. Upwelling stimulates phytoplankton blooms and production of zooplankton and juvenile fish, which are the prey-base for the seabirds of the Refuge. Seabird populations and productivity of 11 species were monitored by PRBO by cooperative agreement and results are shown in Table 2 below.

Table 2. South Farallon Breeding Seabird Populations

	1999		2000		2001		2002		2003		2004		2005		1995-2004
SPECIES	BP	YF	BP	YF	BP	YF[6]	BP	YF[6]	BP	YF[6]	BP	YF	BP	YF	Avg. Breeding Pop.
Ashy storm-petrel[1,2]	2,661[3]	0.74[6]	2,661[3]	0.67[6]	2,661[3]	0.56[6]	2,661[3]	0.55[6]	2,661[3]	0.64[6]	2,661[3]	0.56[6]	2,661[3]	0.56[6]	N/A
Double-crested cormorant	468	N/A	402	N/A	402	N/A	486	N/A	392	N/A	458	N/A	130	N/A	427
Brandt's cormorant[1]	6,345[5]	7,614	5,896[5]	6,692	6,570	6,504	9,466	9,513	11,222	5,667	16,754	18,094	11,732	11,380	8,754
Pelagic cormorant	222[5]	141	260[5]	159	416	470	442	572	510	564	706	815	28	0	378
Blk oystercatcher	30	26	26	N/A	30	6	22	10	26	14	26	13	30	14	22
Western gull[1]	19,767	3,063	15,544	4,818	18,235	2,918	15,095	7,095	16,838	6,819	17,969	12,039	16,547	6,784	19,241
Pigeon guillemot	468	267	568	335	502	331	499	365	500[7]	230[7]	1,096	756	1,250	262	758
Common murre	58,878[5]	24,082	53,301[5]	21,853	68,194[5]	27,619	103,588	39,881[4]	107,105	38,558[4]	169,079[5]	68,477[4]	183,092[5]	43,027[4]	80,890
Cassin's auklet[2]	15,239	6,324	15,239	6,324	16,690	8,762	18,807	11,096	23,692	10,661	29,229	9,353	16,202	0	20,524
Rhinoceros auklet[2]	N/A	N/A	N/A	0.66[6]	N/A	0.64[6]	N/A	0.62[6]	N/A	0.45	N/A	0.61	N/A	0.33	N/A
Tufted puffin	118	N/A	74	N/A	102	N/A	128	N/A	N/A	N/A	190	N/A	50	N/A	109

*BP= Breeding population; YF= Number of young fledged; N/A= Data not available.

(1) Farallon National Wildlife Refuge contains the world's largest breeding colony for species.
(2) Estimates from Southeast Farallon Island only.
(3) 1992 Estimate (Sydeman et al 1998). More recent population estimate not available.
(4) Murre chicks fledged/pair based on pooled data from three productivity plots (prior to 2002 YF was based on Upper Shubrick only).
(5) Population estimate from land based survey only. No boat survey conducted.
(6) Young fledged includes relays. For ashy storm-petrel and rhinoceros auklets, figure is young fledged/pair.
(7) Pigeon guillimot data from evening raft counts. Using morning raft counts, population estimate = 2,383 & young fledged= 1,096
NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite

The breeding population for Farallon seabirds during 2005 reversed a steady upward 4-year trend for most species, and was in stark contrast to the exceptional 2004 breeding season. During 2004, breeding population sizes for all species (except western gulls) were well above the 10-year average. In 2005, breeding population sizes for most seabird species were below the 10-year average. Exceptions were Brant's cormorant, common murre, pigeon guillemot, and black oystercatcher.

Productivity of Farallon seabirds during the 2005 breeding season was considerably lower than in 2004 and below the long-term mean for all species except Brandt's cormorant. The warm water conditions observed for most of the seabird season, lack of upwelling along the coast, and poor ocean productivity during the early part of the breeding season were likely causes of the poor seabird performance. Sea surface temperatures (SST) were 0.5°C above average in January and February and more than 1.0.5°C above average in March and May. Of particular importance was very warm water in March when seabirds typically start breeding, and a spike in SST in May corresponding with the timing of abandonment for Cassin's auklets and pelagic cormorants.

In 2002 the **ashy storm-petrel** was identified as a "Bird of Conservation Concern" by the USFWS. Birds on this list represent the Service's highest conservation priorities. Without additional conservation actions , these birds are likely to become candidates for listing under the Endangered Species Act. PRBO analyzed population viability for the ashy storm-petrel in 1998. This analysis concluded that the population is not in imminent danger of extinction, but should be considered threatened; population viability is a concern.

The most recent SEFI **ashy storm-petrel** breeding population estimate of 2,661 was made from banding data in 1992 (Sydeman et al. 1998). This study reported a 35% - 40% population decline of breeding birds between 1972 and 1992. However there is some indication, based on the number of birds banded each season, that the population may be increasing in recent years. The mean standardized capture rate (number of birds caught per hour of effort) has increased from 11 birds/hour in 1999 to 31 birds/hour in 2005. Detailed analyses of mark/recapture data is needed to determine petrel's population status.

A high rate of predation on adult birds of this long-lived, slowly-reproducing species continues to be of concern. The 2.87% per year decline between 1972 and 1992 roughly equals the number of predated ashy storm-petrel carcasses observed annually. Gulls and burrowing owls are the main predators. It is suspected that introduced house mice are indirectly responsible, in part, for petrel declines. The high fall mouse population entices some migrating burrowing owls to over-winter. When the mouse population crashes, starving owls turn to storm-petrels as a food source. Management actions are being implemented to reduce the conflict (Sections G.6 and G.15).

Re-construction of the Shubrick murre blind had to be put on hold during late summer 2004 when nesting petrels were discovered underneath the old structure. The blind was completed in November 2004, and nesting petrels re-colonized the structure during the 2005 breeding season as evidenced by petrels calls heard in June.

The population of **Brandt's cormorants** breeding on South Farallon Island has declined since the 1970s, when the breeding population exceeded 20,000 birds. Between the late 1980s and 2000, the Brandt's population has fluctuated but population estimates never exceeded 11,000 birds (Table 2). But like many other species on the Farallons, their populations have grown

considerably between 1999 and 2004. The growth trend was reversed in 2005 with the Brandt's cormorant population declining by 30%. The population estimate on Table 2 was based on a total of 5,866 well-built nests counted during PRBO ground surveys conducted June 13, and a boat survey conducted June 16. Brandt's cormorants had relatively high productivity compared to other seabirds (Fig 1), although some nest abandonment was observed.

The Service and Humboldt State University conducted a survey of all coastal Brandt's and double-crested cormorant colonies in 2003, and compared them to 1979-80 and 1989 surveys (Capitolo et al. 2004). They found that the central California Brandt's population was 38% higher in 1989 than in 1979-90, demonstrating population growth at the same time as the drop at South Farallon Islands. They concluded that birds moved from the Farallons to colonies south of Monterey Bay (in the mid-1980s), and later (in the mid 1990s) to new colonies that formed at Año Nuevo and Alcatraz Islands. Still, the Farallon Brandt's colony remains the largest in the world, and contains 25% of California's breeding birds.

The **double crested cormorant colony** is located on Maintop on West End. On 15 June, a peak number of 65 well-built nests with birds in incubation posture were counted. Multiplying this count by 2 yields a breeding population of 130 birds. This estimate is 72% lower than 2004, and 70% below than the 10-year average (Table 2). No reproductive data is collected on this species due to poor visibility of double crested cormorant nests.

Pelagic cormorants declined substantially over the past two decades, but like many other species on the Farallons, their populations grew considerably between 1999 and 2004. The growth trend reversed in 2005, when the population estimate was 95% lower compared to 2004 and 93% lower than the 10-year average. The breeding population of 28 was based on a total of 14 well-built nests counted during land-based and boat-based surveys conducted on 4 June and 16 June, respectively. All of these nests were subsequently abandoned before any chicks hatched, so island-wide production was estimated to be zero fledglings during 2005 (Fig 1). This is the first year of zero reproduction since 1993.

The **western gull** breeding population trend on SEFI has been generally downward over the past two decades. While population numbers are still much reduced from those observed in the 1980s and early 1990s, western gull numbers have been slowly increasing over the past few seasons. The 2005 estimated breeding population of 16,547 birds was 8% lower than in 2004 and 14% below the 10-year average (Table 2). After a steady increase in productivity over the past four seasons, western gull productivity showed a marked decline (Fig 1), approximately 24% below the long-term average.

The peak count of 1,250 **pigeon guillemots** on 7 May was approximately 14% higher than the peak count from 2004, and 65% higher than the 10-year average (Table 2). This breeding population estimate, as in previous years, was derived by counting adults rafting on the water around SEFI at dusk through the month of April, before the birds begin attending their nesting sites. Since this census method does not distinguish between breeders and non-breeders, it is highly likely that in poor reproductive years, such as 2005, a larger portion of the rafting birds are non-breeders. Therefore, the 2005 population estimate probably does not represent a true increase in the number of breeding birds.

Pigeon guillemots were monitored at 134 sites on Lighthouse Hill, Garbage Gulch, and the Habitat Sculpture, of which 54 were observed with at least one egg (40% of total monitored sites). One nest was located in the habitat sculpture, for the third year in a row. Productivity as 70% lower than last season and approximately half the 34-year average (Fig. 1).

Historically the **common murre** population on the Farallon Islands was estimated at 400,000 or more birds. Egg collecting, oiling, and human disturbance drastically reduced these numbers. Murres were beginning to recover in the late 1970s and early 1980s (Fig. 1), but were decimated by a series of oil spills and high adult mortality in gill net fisheries. However, favorable oceanographic conditions, abundant prey, coupled with relatively strong reproductive success and protection from human-caused mortality, led to incredible population growth and average of 24% per year between 1999 and 2004).

PRBO's 2005 South Farallon Island **common murre** population estimate of 183,092 (Table 2) is the highest yet observed since standardized studies began in 1971 and well above the 10-year average. This estimate is derived from land-based surveys conducted by PRBO between 7 and 11 June, and a correction factor to account for the proportion of the population that would normally be censussed from the boat. The boat portion of the survey was not conducted this year due to unfavorable weather conditions.

Aerial surveys conducted by USFWS on 10 June 2005 have not yet been counted. Aerial surveys in 2004 came up with came up with the following murre breeding population estimates: North Farallon Islands = 62,022; South Farallon Islands = 109,853; These estimates were derived from applying a correction factor of 1.44 (used for PRBO's population estimate) to the raw numbers counted: 43,071 and 76,287, respectively for North and South Farallons. These numbers are preliminary and may change upon further analysis (McChesney et al.2005).

The common murre banding and diet sampling conducted in February and March 2005 was successful on most accounts. Most importantly, 218 birds in the Shubrick study plot were individually color banded with no adverse effects to the colony and relatively little disturbance. Most birds in attendance on Shubrick Point flushed during the capture and processing operations, however, many of the birds began returning to roost within 45 minutes (while researchers were still in the study plot banding birds). The entire colony returned to the study plot the day following the banding. All but one of the banded birds were re-sighted during the 2005 breeding season, and murres in the Shubrick study plot had approximately the same breeding success as murres at other locations around the island. Unfortunately, the 30 diet samples taken revealed that the birds had empty stomachs at the time of capture, so the dietary goal of the study was not met.

The SEFI **Cassin's auklet** breeding population estimate is considered very rough, and is based on counts of burrows and crevice nesting sites. Population censuses are very difficult due to the bird's nocturnal behavior and burrowing nesting habits. The most recent complete survey of all burrows and crevices on South Farallon Islands, conducted by USFWS in 1989, produced an estimate of 29,880 breeding birds on SEFI (38,274 for all South Farallon Islands). A burrow occupancy rate of 75% was used as a correction factor. Since 1991, PRBO has monitored Cassin's auklet burrows and crevices in twelve index plots on SEFI in order to detect population trends. The difference in index plot burrow density each year is applied to the 1989 USFWS

population estimate to roughly estimate the current year's population. The SEFI 2005 breeding population was estimated at 16,202 birds. This is 45% lower than 2004, and 21% lower than the 10-year average. (Table 2).

After five years of rapid population growth and above average productivity, Cassin's auklets experienced the lowest reproductive success in the 35 years they have been monitored on SEFI. Occupancy of monitored nesting boxes in 2005 was only 32 %, compared with 83% in 2004. The 94% rate of egg abandonment for monitored boxes was extremely high. The reason for this almost complete reproductive failure seem to be oceanographic conditions which led to a massive reduction in the availability of krill, the auklets primary prey, for most of the spring and summer. Oceanographic conditions were the poorest observed since the 1998 El Niño resulting in delayed breeding, mass abandonment of breeding attems, reduced hatching and fledging susuccess, and high chick mortality of eggs that hatched.

Rhinoceros auklet population size could not be estimated due to difficulties in censusing this crepuscular, burrow-nesting species. Rhinoceros auklet pairs bred in 42% of 149 monitored sites (boxes, crevices, and cave sites). Auklets produced 0.33 fledglings per pair in 2005, which was 46% lower than the previous year and 41% below the 17-year average (Fig. 1).

The 2005 **tufted puffin** breeding population estimate of 50 birds is less than half of the 10-year average (Table 2). Population size is based on the number of occupied breeding sites observed during two 1-week periods (mid-May and early August). Many more puffins were observed throughout the season, but they were not regularly attending breeding sites and hence are not included in this estimate. Productivity cannot be estimated due to the inaccessibility of nesting crevices.

Black Oystercatcher breeding population is estimated by censusing all known breeding sites visible from Lighthouse Hill and the Marine Terrace. The estimate does not account for birds on parts of West End Island not visible from the SEFI vantage points. Of the 31 sites that were monitored during 2005, 15 were attended by a breeding pair which had eggs and/or chicks, and 14 fledglings were produced. This estimate is 15% higher than 2004.

Oiled Birds: During the 1990s and early 2000s, winter storms coincided with large numbers of oiled birds found washed ashore or swimming in waters around the Farallon Islands. In 2002 the source of this oil was finally discovered, and 100,000 gallons of oil were removed from the SS Luckenbach a sunken ship southeast of Farallon Islands. Since the Luckenbach cleanup, the number of oiled birds observed on and around the islands has decreased substantially. During 2005, a total of 22 oiled birds were counted, spread evenly throughout the year (2-5 per month). Counts of oiled birds included the following species and individuals: common murres (2); western gulls (14), Cassin's auklet (1), rhinoceros auklet (2), pigeon guillemot (2), Brandt's cormorant (1).

6. Raptors

One to four peregrine falcons were present throughout the winter, early spring, and fall months (Jan-April and Sept-Dec). Peregrine falcons feed primarily on Cassin's auklets and common murres at sea near SEFI, based on numerous carcasses found at island feeding sites.

Two burrowing owls over-wintered during the 2004/05 winter, which is typical of most years. In March they were confirmed to be dining on ashy storm-petrels when the remains of 50 owl-depredated ashy wings were found. This is characteristic of most owls that overwinter, as they turn to seabirds as a food source once the mouse population crashes in late winter and petrels return to stake out breeding sites. For the past several years, we have had a protocol in place to trap and transport over-wintering owls to the mainland. However, we have been unsuccessful in catching them.

Finally on April 3, and again on April 18, PRBO Farallon Biologist Russ Bradley outwitted the burrowing owls, trapping them in rhinoceros burrows using a PVC pipe and fabricated cage (see photo). One owl was lured out of his hiding place by playing ashy storm-petrel calls! Both owls were transported from the island on the next available boat (during which time they were kept in a box and fed for 1-4 days) and released on the Warm Springs Unit of the Don Edwards San Francisco Bay NWR in South Fremont. On November 5 another burrowing owl, which had been on SEFI for at least two weeks and was likely to overwinter, was captured in a mist net and transported by helicopter to the mainland. It was also released at Warm Springs.

All three burrowing owls translocated during 2005 were placed into vacant artificial burrows in an area favored by burrowing owls. Dead mice were left in the burrow and the hole was plugged for the first night; then mice were brought to the entrance and left daily for 3-7 days following the release to entice the owls to stay. All three owls were banded with aluminum USGS leg bands, one was color banded, and the release sites were checked by interns and staff opportunistically. Fate of the owls is inconclusive, except we know for certain they did not return to the

Farallon Islands. The color banded owl was confirmed at Warm Springs 10 days post-release, and suspected to have remained there for 3-1/2 months; it was seen several times at the artificial burrow entrance with another owl, indicating possible pairing.

Another burrowing owl remained on SEFI, through the end of 2005, eluding all attempts to capture it. Due to the difficulty in capturing SEFI burrowing owls, their impact on ashy storm-petrels, and the fact that most overwintering owls die from starvation or are killed by gulls, house mice eradication is the long-term solution. Without this artificial food source which lures burrowing owls in the fall to overwinter, and then collapses, migrating owls will continue on to more suitable mainland wintering areas like other landbirds. In November 2005 the National Fish and Wildlife Foundation (NFWF) funded the environmental documentation and permitting phase of the Farallon Mouse Eradication Project.

7. Other Migratory Birds

Although there are no resident landbirds on the Refuge, Southeast Farallon Island is well known for the number and diversity of landbirds that arrive on the island during spring and fall migrations. Many of these landbirds are common western birds, however, the birds that attract the most attention are "vagrants", common elsewhere in the US or other countries, but not normally found on the west coast or in California. Most vagrants that have been captured and aged on the Farallon Islands are juvenile birds. Species and individuals are tallied daily (year-round) by searching the few areas frequented by landbirds, and mist nets are operated between mid-August and early December to determine the numbers of arrivals and how long they stay. Over 400 species of birds have been recorded for the Farallon Islands.

During the fall season 2005, a total of 190 species were observed on the island, and 34 seabird species were observed from land. Seven mist-nests captured 1,101 new birds and 439 recaptured individuals. The most common species captured during 2005 were similar in composition to the most numerous species in previous years: yellow warbler, yellow-rumped warbler, ruby-crowned kinglet, golden-crowned sparrow, and white-crowned sparrow. Vagrant species numbers were also consistent with past years. Seven very rare species were documented during fall 2005: brown booby, ruby-throated hummingbird, arctic warbler (first island record), yellow-bellied flycatcher, blue-headed vireo, Connecticut warbler, and mourning warbler.

9. Marine Mammals

Weekly all-island pinniped counts of haul-out areas on South Farallon Island (SFI) are conducted throughout the year. Maximum populations and breeding success for the five pinniped species using the South Farallon Island during the last nine years are shown in Table 3. Average monthly numbers of pinniped populations for the past three years are shown on Table 4.

Guadalupe fur seal sightings are not included on Table 3. One to several animals are seen in some years during the early fall or winter since the first historic sighting of this species in September 1993.

Table 3.-(A) Maximum Population Numbers (Peak Monthly)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
California Sea Lion	4303 (Aug)	4990 (July)	7837 (Oct)	5270 (Jan)	2423 (Sept)	3301 (Aug)	4480 (June)	5630 (Feb)	5292 (Jan)	4263 (Aug)
Steller Sea Lion	213 (Nov)	148 (Nov)	253 (Dec)	133 (Oct)	174 (July)	261 (May)	304 (Nov)	373 (Mar)	149 (May)	202 (Apr)
Harbor Seal	144 (Sep/Oct)	141 (Sept/ Nov)	190 (Feb)	125 (Feb)	128 (Dec)	150 (Dec)	168 (Jan)	180 (Jan)	166 (May/ June)	136 (June)
Northern Elephant Seal	590 (Jan)	571 (Nov)	406 (Jan)	623 (Nov)	1019 (Nov)	843 (Oct)	736 (Nov)	1009 (Nov)	594 (Apr)	568 (Apr)
Northern Fur Seal	10 (Aug-Oct)	8-12 (Sept)	4 (Nov)	22 (Aug)	13 (Sept)	18 (Sept)	35 (Sept)	22 (Sept)	38 (Sept)	90 (Aug)

Table 3.-(B) Number of Pups or Pups/weaners Produced

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
California Sea Lion	16	0	31	17	33	12	13	48[4]	12	17
Seller Sea Lion[1]	5	4	10	11	9	11	7[4]	13[4]	22[4]	10[4]
Harbor Seal	1	2	4	2	1	1	3	2	1	6
Elephant Seal[2]	308/231	274/210	250/192	198/158	174/127	156/139	136/115	149/109	156/117	158/113
N. Fur Seal[3]	1	4	1	3	4	5	13	8	11	24

N/A= Data not available

[1] Maximum numbers of pups observed during any one June/July census.

[2] Number of pups born/number pups weaned

[3] Number of pups observed during August visit to West End, except if otherwise noted

[4] Number of pups counted by NMFS aerial census

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

Table 4. Average Monthly Pinniped Numbers - South Farallon Island

	CA Sea Lion			Steller's Sea Lion			Harbor Seal			Elephant Seal			N. Fur Seal		
MONTH	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005	2003	2004	2005
JAN	1000	3698	1908	155	26	28	180	50	88	160	175	87	0	3	1
FEB	4500	2028	1677	40	24	55	150	40	44	150	166	173	0	0	0
MAR	2604	1109	702	55	55	106	72	63	77	130	135	210	0	0	0
APR	1808	1616	904	75	84	136	57	55	45	488	450	420	0	0	0
MAY	2436	1843	1483	94	72	123	77	34	87	427	305	302	0	0	0
JUNE	3995	1662	1945	70	63	94	80	90	93	65	73	80	2	3	0
JULY	3289	1886	1990	43	85	71	80	119	119	12	23	19	1	7	20
AUG	3014	2135	3810	29	38	68	58	28	96	52	43	39	2	7	38
SEPT	1801	1235	2680	40	52	18	67	49	38	288	167	176	10	14	22
OCT	3110	1522	2833	86	52	46	82	36	50	474	372	378	6	5	7
NOV	3588	650	2260	131	64	34	67	55	30	828	375	242	1	2	16
DEC	2348	1082	1955	27	25	42	32	33	30	171	171	187	8	3	4
TOTAL	33493	20466	24147	845	640	821	1002	652	797	3245	2455	2313	30	44	108
Avg/Mo	2791	1706	2012	70	53	68	84	54	66	270	205	193	3	4	9

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

The National Marine Fisheries Service Southwest Fisheries Sciences Center analyzed pinniped population trends in the Gulf of the Farallons during the period 1973 to 1994. Some of the following discussions is based on the report prepared by Sydeman and Allen (1996).

California sea lions, primarily immatures, haul-out on SFI year-round. They are the most abundant species of pinniped on the Refuge. Sea lions numbers increased significantly at SFI between 1973 and 1994, at an average rate of 6.4% per year. Peak California sea lion abundance was observed in the years of the 1983, 1992, and 1998 El Niño Southerly Oscillation (ENSO) events. Average monthly California sea lion numbers during 2005 (Table 4) were typical of normal years. Peak monthly counts did not exceed 5000 animals.

Most California sea lion young in California are produced south of Point Conception, with the Farallons representing the northern breeding limit for the species. Prior to 1998, only a few pups are born on the Refuge each year, but more pupping has occurred since the 1998 El Niño. Seventeen pups were counted from PRBO ground counts this year, which may miss some animals. NMFS aerial surveys counted 11 pups.

Occasionally the Marine Mammal Center releases rehabilitated pinnipeds around the Farallons. Four immature California sea lions were released in Fisherman's Bay during April, and another 4 were released in May.

In contrast to the California sea lion, the Farallons are near the southern breeding limit of the **Steller sea lion**, which pups only as far south as Año Nuevo. Steller sea lions breed in small numbers in spring and summer (May through August) on the South Farallon Islands, and haul-out in larger numbers throughout the year. Births occur from late May through mid-July and copulation occurs 1-1/2 to 2 weeks after postpartum. Females typically return to the same pupping site in successive years. It is possible that pupping and breeding occurs on North Farallon Island, as Steller sea lions have been observed there, but data is lacking.

The average number of Steller sea lions on SFI during 2005 was 68 (Table 4). The peak number of Steller sea lions counted during the breeding season was 202 in April (Table 3A). The high count of pups counted from mainland vantage points in July was 9, however the National Marine Fisheries Service counted 10 pups during their July aerial survey. Their remote rookery location on West End makes it difficult to monitor reproductive success from land.

Another influx of Steller sea lions occurs on SFI in the fall (September to December) when mother-pup pairs from Año Nuevo haul-out on SFI.. Fall numbers peaked at 90 in December, which is a comparatively low fall peak.

Pacific harbor seal populations on SFI grew at an annual rate of 10.4% between 1973 and 1994. This increasing trend is probably explained by poor food availability which has forced seals to leave their coastal foraging grounds and search for food in more pelagic waters. Marked peaks in abundance occur during ENSO such as 1998 when an all-time high of 190 harbor seals were counted (Table 3A). The 136 peak seal count in June (Table 3A) was the lowest in the past 10

years, however average monthly numbers were typical of recent years (Table 4). The Harbor seals sometimes pup on SFI, and six pups was noted this year. A radio-tagged harbor seal from the San Francisco Bay study, stylishly outfitted with green tags and a turquoise radio, was spotted on Mussel Flat in February.

It is estimated that over 80,000 **northern fur seals** used the Farallons during the breeding season prior to the arrival of American and Russian sealers in the 1800s. This species was extirpated from the Farallons due to intensive hunting in the early 1800s, and until 1996 northern fur seal use consisted of immatures occasionally being seen around, or hauled out on, the island. In 1996 the first fur seal pup was recorded on West End. Until this historic Farallon birth, northern fur seals were only known to breed in Alaska and the Channel Islands in North America.

More pups continue to be born each year, and the 24 northern fur seal pups were observed on West End this year (Table 3B) double any previous counts. The breeding site was located in the same area previous years: In Upper Mirounga Valley near Pastel Cave Highlands. Since pupping sites are not visible from land or sea vantage points, pups can only be monitored by accessing West End on foot in the early fall after seabirds have left their breeding sites. Total fur seal population numbers have grown exponentially in recent years, and the 90 counted during the annual census included at least 3 bulls and 3 cows.

Derek Lee testing Elephant Seal Weighing Scale

Elephant seals were also extirpated from the Farallons, but returned in 1959 and began breeding on SFI again in 1972. Elephant seal births between 1973 and 1983 followed a pattern of exponential growth, increasing at a rate of 56.5% per year. The SFI population apparently reached carrying capacity in 1983, and between 1983 and 2000 the number of pups produced declined an average 3.5% annually. In 1983, a peak of 475 pups were born, compared with an estimated 158 births during the 2005 season. Since 2000, however, the numbers of cows, pups and weaners have been stable to slightly increasing.

Factors contributing to the decline of elephant seals observed in the late 80s and 90s were deterioration and erosion of beaches that are important pupping areas by winter storms, wave action, and heavy use by pinnipeds. Competition for space with California sea lions may also be a contributing factor in this decline.

In the 1980s, major elephant seal breeding activity shifted from SEFI to West End after severe winter storms in 1983 eroded access routes at the main SEFI breeding area. Winter storms during

the late 90s eroded West End beaches, so that currently more elephant seal breeding activity takes place on SEFI than on West End.

Reproductive success of elephant seals was monitored daily at four Southeast Farallon Island sub-colonies and during 2-3 visits/month to the two West End sub-colonies. The first pregnant elephant seal cow of the 2004-05 season, First Cow, arrived on December 12th , 2004. First Cow has been first to arrive, first to pup and first to wean since the 1999/2000 season.

A **sea otter** observed diving and foraging in Mirounga Bay on October 4 was the most unsual marine mammal sighting during 2005. This was only the 3rd island record for sea otter which normally don't occur north of Monterey Bay in California.

PRBO has been recording **cetacean** sightings from SEFI, since 1973. Observations of most species have increased, probably due to population increases of some species (e.g., gray, blue, and humpback whale), increased effort, and observer bias (PRBO personnel have possibly become better at sighting whales). Gray whales are commonly observed migrating during winter months, southbound in early winter and northbound in late winter. Throughout January,133 gray whales were counted heading south, and 173 were observed heading north during February. Three to four gray whales were seen frequently feeding around the island during June. Other species observed during 2005 were blue, humpback, Sei, and orca whales; Dall's porpoise; Pacific white-sided (including one pod of 550 in February, Risso's (including a pod of 120 in October), and northern right whale dolphins.

In December 2005 a team of divers organized by *Superfish* skipper Mick Menigoz freed a 50-foot **humpback whale** that was entangled in crab pot ropes several miles east of the Farallon Islands. They cut off 12 crab pots and 20 ropes that were cinched around the whale's tail and flipper in a delicate and risky operation that lasted over an hour. After being freed, the divers were thrilled to get a "whale thank-you" when it swam around and nuzzled each diver.

11. Fisheries Resources

Warmer than average water from March to August 2005 translated into less fisheries resources. National Marine Fisheries Service trawls found few juvenile rockfish in their May trawl survey near the Farallon Islands. It is therefore no surprise that juvenile rockfish were virtually absent from chick diet during 2005, representing less than 2% of prey composition for all seabird species. Anchovies were the predominant prey in the diet of common murres and rhinoceros auklets while sculpins comprised the majority of the guillemot diet.

California Department of Fish and Game has issued two fishing regulations over the past several years that will protect Faarallon seabirds and their food supplies. In 2002 ocean waters 60 fathoms and less were permanently closed to gill and trammel nets from Point Reyes to Point Arguello. In 2004, the Squid Management Plan closed the Gulf of the Farallones Marine Sanctuary to night fishing, eliminating the problems of illuminated squid fishing boat operations disturbing nocturnal seabirds (auklets and ashy storm-petrels).

Island personnel and others observed the long-line fishing boat Catherine close to the island several times during 2005 with dead seabirds on its line that uses multiple hooks. USFWS and NOAA enforcement agents were notified.

Waters around the Farallon Islands are a major aggregation site for white sharks, particularly in the fall when elephant seals congregate. PRBO continued to monitor shark predation events from the Lighthouse during fall 2005. Between September and November 54 white shark feeding events were observed, with 24 of those attacks on northern elephant seals 11 attacks were on California sea lions, and 23 attacks were on unknown prey.

Island-based white shark research that involved satellite tagging was phased out in 2004 in order to devote scant island resources to other priorities, and because of logistics and safety issues with launching/mooring the shark research vessel on-island. Stanford University continued a boat-based shark tagging project (initially started by PRBO in 1999) in waters near the Refuge in 2005. Pop-off satellite tags have revealed that most sharks traveled to a region of the Pacific roughly halfway between Baja and Hawaii after leaving the Farallons.

15. Animal Control

The Refuge and PRBO continued planning and data collection for a project to eradicate non-native house mice from SEFI because of their adverse affects on the natural ecology (Section D.5 and G.6). An report analyzing the 3 years of monthly/ bi-monthly snap trapping conducted 2001-2003 to document mouse population cycle (*Mus musculus*) was completed. The mouse population is cyclic, peaking in the late fall before crashing late winter. Burrowing owls arrive when the mouse population is highest and some owls are lured to attempt to over-winter because of the abundance of mice upon their arrival. When the mouse population crashes, the owls begin to eat ashy storm petrels, that are returning in the early spring to their breeding territories.

To protect ashy storm petrels, which are declining due to predation, to conserve burrowing owls (most of the over-wintering owls die), and to restore a more natural balance, mice will be removed when funds become available. In November 2005, the Refuge partnered with the non-profit organization Island Conservation, to complete the Environmental Documentation and permitting requirements for the eradication. Island Conservation received a $149,500 grant from National Fish and Wildlife Foundation (of which $38,400 was earmarked for the Refuge) for the project. Funding for project implementation is included in the draft restoration plan for the Luckenbach Oil Spill, which will be finalized in 2006.

16. Marking and Banding

PRBO banded seabirds during the summer and landbirds during the fall. Since 1971, western gulls in study plots have been banded with U.S. Banding Lab metal and colored bands. Common murre chicks in the Upper Upper colony are banded in July. Adult common murres (218) were color banded with unique color combinations in Feb/March 2005. This will enable monitoring of known individual for many years to come in the Shubrick study plot. Brandt's cormorant chicks were banded at three sites: Shubrick, Sea Lion Cove, and Corm Blind. Pigeon guillemot, Cassin's

auklet, and rhinoceros auklet chicks are banded in monitored nest box/natural burrow sites with metal and/or color bands. Rhinoceros auklet adults are banded when captured in mist nets during diet studies. Since 1992 a mark/recapture study has involved mist-netting and banding ashy storm-petrels and Leach's storm petrels with metal bands. Some individual birds have been followed as nestlings through 20 years or more of life by reading numbers on metal bands.

Elephant seals are tagged with two numbered pink plastic tags on the hind flippers. These animals can then be identified on the Refuge and at other sites in California, and provide information about longevity and movements. Farallon-born elephant seals have been observed at haulouts on San Nicholas Island, San Miguel Island, Año Nuevo and Castle Rock NWR in California, and on Isla San Martin, Baja Mexico.

17. Disease Prevention and Control

Botulism-killed western gulls are seen periodically throughout the year. It is assumed that they contract the disease while feeding in mainland dumps.

Pinnipeds with materials such as packing straps, monofilament, and salmon lures constricting their necks or other body parts are often observed hauled-out on the Refuge. Typically, 45-60 "ringed" pinnipeds are observed per year. The vast majority (around 90%) are California sea lions, but northern elephant seals, Steller's sea lions, and harbor seals are sometimes encountered (Hanni and Pyle. 2000). During 2005, over 90 "ringed" pinnipeds were observed.

H. PUBLIC USE

1. General

The Farallon National Wildlife Refuge is closed to the public. However, sightseeing boats cruise the waters around SEFI to observe mammals and seabirds. Boats were recorded during most months, although peak numbers visited in late summer and the fall. A total of 84 sightseeing boats with an estimated 2,554 people on board were recorded during the 2004, and 79 boats with an estimated 2,023 people on board were recorded during 2005. *The Superfish* began operating a shark-watching concession for cage divers and topside viewers in 2004, which continued in 2005. The operated 5 days a week from mid-September to mid-November and brought an estimated 400 shark watchers in 40 trips per season.

Media visits offer additional opportunities to educate the public about Refuge wildlife. Typically, the Refuge issues 1-3 Special Use Permits, each allowing 1 or 2 media (usually a reporter and a photographer) per year. During 2005, because of the increased level of public interest following Congressman Richard Pombo's bill to open the Refuge to public visitation, the Refuge organized the first ever "Farallon Media Trip" in May 2005. Twelve reporters/photographers from the San Francisco Chronicle, Sacramento Bee, Contra Costa Times/Knight-Ridder newspapers, Associated Press, KGO/Channel 7 televison news, Ocean Futures, a BLM videographer, and Sacramento Service media relations staff toured the island for several hours. Numerous positive newspaper and TV coverage resulted from this very successful trip.

Another media first was the Farallon's appearance on the radio talk show, "Car Talk." How can a Refuge without any vehicles or motorized access be featured on a show about unique car problems? Show hosts thought our problems with the Webasto hot water heater were interesting (and wacky) enough to be make the air waves when the island biologist called in (with gulls screeching in the background).

The Farallons were jettisoned from sleepy Refuge in the fog to front page news between February and April when a bill that would have opened up the Farallons and 2 other Caribbean Refuges to pubic visitation was introduced by Congressmen Pombo and Rahall (WV). The Bill, H.R. 298, inspired primarily by a segment of ham radio operators who wanted to broadcast from these closed Refuge, drew swift and significant opposition from the public, local organizations, State Assemblyman Yee, and San Francisco Supervisor Jake McGoldrick. A town meeting organized by Yee and McGoldrick drew a crowd of 70, almost unanimous in their support of continued restrictions to public access. Pombo and Rahall withdrew the Bill following this meeting and opposition from other local Congressional Representatives: Tom Lantos and Nancy Pelosi.

7. Other Interpretive Programs

Nine naturalists from the Oceanic Society, including their Executive Director Birgit Winning, came ashore for an on-island tour by the Refuge Manager and PRBO Staff in August. The purpose was to familiarize Oceanic Society naturalists who conduct Farallon public boat tours with Refuge operations and resources. Skipper Chris Duba, a charter boat skipper, and his crew also participated in the tour.

Approximately 125 people attended two Farallon interpretive programs given by Refuge Manager at the California State Fair in September. The kids enjoyed watching Don Edwards Refuge Manager Clyde Morris be turned into a seabird.

The Refuge's seabird education program was expanded to include the Farallon Refuge and National Marine Sanctuary. A curriculum called "Webs Under Waves" was developed and piloted in fall 2005. New partners (PRBO and GFNMS) and new schools in San Francisco, Marin, and Fremont were added.

During 2005 the Refuge Manager made two presentations to Berkeley University classes in Land Use and Conservation. The Farallons were featured in *Tideline* articles in 2005 (Burrowing Owl Relocation) and 2004 (Debris Cleanup by Coast Guard).

17. Law Enforcement

USFWS regulations prohibit wildlife disturbance. Low level flights (below 1000') frequently flush wildlife so aircraft flying under 1,000' over the island are treated as potential violations. Several aircraft flushed wildlife when they flew too low over the island. Island personnel document such

events if they can get a tail number and submit a violation report to Refuge law enforcement personnel.

Jet skis have been banned in the GFNMS since October 2001. The waters within one nautical mile of the Southeast and North Farallon Islands have been established as California State Ecological Reserve, and boating restrictions prohibit boats within 300 feet of most of the shoreline between March 15 and August 15 (Section 630 (b) (71), Title 14, California Code of Regulations). Nine boats were documented violating the seasonal boat closure area in 2005. California Dept. of Fish and Game, who enforces the closure, were contacted when sufficient identifying information could be gathered on the boat(s).

Refuge Officers collected evidence and conducted interviews for an enforcement action against Susan Casey, the Times Inc. reporter who trespassed on the Refuge, violated terms of her Special Use Permit, and generally misrepresented her intentions to write a book (*Devil's Teeth*) on great white sharks. The US Attorney decided not to pursue the enforcement action.

I. EQUIPMENT AND FACILITIES

1. New Construction

A manually powered derrick was installed at North Landing in the winter of 2004/2005. Landing platforms made of "Fibergrate" were installed at the intertidal zone to eliminate scrambling over seaweed covered rocks during landings. California sea lions enjoy the level surface of the platforms. Fibergrate and railings were installed around the base of the crane to make it more user friendly and improve safety. See Section E.6.

A modern septic system was installed to service both houses in the fall of 2005. The Orenco system was designed to accommodate up to 16 people and requires minimal maintenance. The system consists of 2 buried 1500 gallon separation tanks laid end-to-end with internal baffles. The effluent gravity feeds through the 4 chambers where it is pumped into 2 large filter pods. The filter pods contain rows of paper-like elements that house bacteria. The bacteria consume the organic materials that flow through the larger tanks. After bacterial treatment, the effluent gravity flows back into the 3rd chamber of the large tanks. The effluent continues to cycle back into the 3rd chamber until it overflows into the pump basin. When the pump basin fills, the treated effluent is pumped to the leach field. The leach field, located between the 2 houses, consists of 4 parallel 40' long perforated pipes spaced 2' apart. An automatic dispersal valve on the supply line rotates which leach pipe is used for each pump event. Unfortunately there are many pumps and switches which will fail at some point in the future. 192 measurements are continuously fed to the internet for monitoring by Bonny Doon Environmental and who oversaw the installation by Battle Mountain Excavation. The pipe to sewer gulch was abandoned and the composting toilet was composted at a landfill on the mainland.

2. Rehabilitation

Water System: During the "2004/2005" rain year (November 2004 - April 2005) 65,500 gallons of water were "harvested" during the collection system's seventh year of operation. Water collection from previous years are shown in the table below. Annual water collection averages 47,877 gallons. Water samples are taken 4 times during the year and tested by Alameda County for coliform and nitrates. Coliform continues to test negative.

YEAR	1999	2000	2001	2002	2003	2004	2005
GAL	38,000	29,830	51,500	49,625	55,687	45,000	65,500

The water filtration system and the pump house received major overhauls in 2005 to reduce sedimentation accumulation in the storage system. Water is now transferred between the settling tank and the cistern by drawing water from the top of the tank instead of the bottom. A stainless steel submersible pump was installed in the bottom of the settling tank to clean out sludge, possibly eliminating the need for the bucket brigade method of tank cleaning. A sand filter was installed in the pump house to provide a way to filter and clean the storage cistern water. It uses a high volume/low pressure pump to circulate cistern water through the sand filter. After the first cycling through the sand filter water, clarity improved to the point that the bottom of the cistern was visible.

To accommodate the new elements, 3/4 of the pump house was torn down, and the building was expanded from $36ft^2$ to $80ft^2$. The expanded section uses posts instead of a perimeter foundation for support. The door was moved to the west side and the existing Jacuzzi pump and bag filters were left in place. All new wiring and breakers were installed and connected to the pumps through Coyote protectors. The cistern roof was coated to protect it from UV rays with left over epoxy paint and aluminized roof coating.

A new UV filter was installed in the boiler room. The new UV filter does not need a continuous water bath so the water return line was abandoned. Most of the plumbing upgrades were done by Jesse Irwin and contractor Glenn Reynolds. Volunteer plumber Andrew Carothers repaired leaks and replaced gaskets in the houses, and prepared a scope of work for future plumbing rehabilitation in the residences

Other Buildings: The North Landing boat house and the Carp Shop we re-roofed in the fall of 2005. Asphalt shingles left over from the house remodels were used at North Landing while fire treated cedar shingles were used on the Carp Shop. A skylight was installed on the boat house. Part of the installation of the derrick at North Landing included installing a roll up door and raising the floor to accommodate a new 15' Zodiac. The power house roof was tarred in March 2005.

Tim Kask re-roofing N. Landing Boathouse

The murre blind was demolished and rebuilt by PRBO in

2004 followed by the corm blind in 2005. Volunteers Charles and Chris Whitfield and Jerry Ellis provided professional carpentry and masonry skills to the project. The new blinds are constructed of marine plywood, with a foundation firmly bolted into solid rock, and are weather tight.

East Landing Derrick: The chronic problems with the boom tip sheave have been alleviated by installing a stainless steel sheave and grease-less polymer bushing replacing the painted sheave and wheel bearing. We also require the maintenance contractor to thoroughly de-rust the cheek-plates. Stainless sheaves and polymer bearings were also installed at the mid-mast and lower mast locations. The new components have been trouble-free so far. North Coast Divers performed the annual maintenance in 2005. The maintenance schedule was revised to included changing the gear oil each year in addition to the truster motor oil. Painting is a never ending task.

Residences: The refrigerators were found to have corrosive sealant leading to early refrigerant leaks. All 3 of the fridges were shipped back to Arcata for extensive repair after a compromise was reached with Sunfrost. Yes, Sunfrost is the manufacturer of the fridges that used sealant corrosive to copper tubing in their own products.

The grey water system was problematic in 2004-2005. The pump was not pumping and the amount of sediment collected with the rainwater was a concern. A sediment trap was installed on the inlet of the grey water tank and a 20 micron filter was installed before the new pump. The main culprit was a course screen located in the copper supply line that was not visible under the pipe insulation. Sediment from the roof shingles had plugged the screen preventing water flowing to the boiler rom but allowing water to flow to the spigot because of the wye-shaped housing. Grey water from the washing machine is now sent to the septic system leaving rain water collection as the toilet water source.

4. Equipment Utilization and Replacement

Generators/Fuel: A new (2004 model) 15kw Kohler replaced Lister 1 in January 2005 and in September 2005 it was not providing enough power so it was flown to mainland for replacement of the rectifier pack by Industrial Electric. A new 2005 15kw Kohler was installed at the same time the repaired 2004 Kohler was reinstalled. The 2005 Kohler was underpowered from the beginning and despite expensive service calls and replacement parts, the generator's current job is to take up space while Lister 2 serves as the back-up. The Honda portable generator was taken to Air-Cooled Engines and throughly serviced. The addition of powerful cordless tools has somewhat reduced the abuse the Honda generator must absorb. Approximately 2,500 gallons of diesel remain in the white tank and diesel bladder which should run the generators and Webasto until about 2010.

Outboard Motors/Boats: The 2003 Safeboat has been successful as the main work platform and landing boat. The Safeboat was purchased to meet OSHA requirements as a personnel lifting device. A 15' Zodiac with a 2004 25hp Honda was purchased for use at the newly overhauled North Landing. All of the old Evinrude outboards were removed from the island leaving the island with 3 Honda 4-stroke outboards (15, 25, 50 hp) and 2 1998 Johnson 2-stroke outboards (4, 15hp).

Residences: The electric motor, combustion chamber, and heat exchanger in the FWS House's Webasto hot water/heating system were replaced in March 2005. The septic contractors installed an on-demand propane hot water system in the Coast Guard House in September 2005.

5. Communications Systems

The radio phone was replaced with a VOIP phone (voice over internet phone), and high speed wireless internet service is hooked up. The communication system upgrades were made possible through a 3-way partnership. The Service purchased radios and other hardware to set up the new link between the island and the mainland at UC San Francisco. UC Berkeley Seismology were the "low bid" (i.e. no cost) contractors doing the installation on the island and mainland. PRBO pays the phone and internet bills.

6. Energy Conservation

March marked the 7-year anniversary of operating the field station on solar power. Performance continues to exceed expectations. Solar power supplied over 90% of the Refuge's power needs, and saved at least 5,000 gallons of diesel fuel during 2005. Fuel consumption since the photo-voltaic system was installed in 1998 is shown below, and averages 634 gal/yr. Applied Power made minor adjustments to the P-V system during their annual service visit in March.

1999	2000	2001	2002	2003	2004	2005
600 g	980 g	546 g	619 g	475 g	579 g	637 g

J. OTHER ITEMS

1. Cooperative Programs

Since solarizing their lighthouse in the early '90s, the US Coast Guard has been reducing its activities on Southeast Farallon Island. They stopped delivering fuel and water in 1997. The USCG still provides helicopter support for Refuge and other government employees during the non-seabird nesting season (August 15-March 15), when landings are allowed.

Joelle Buffa (right) and Coast Guard pilots

The Farallon Patrol is a volunteer group of about 20-30 sailboat and motorboat owners who take turns making twice monthly runs out to the Refuge. Since 1969 they have donated their time, boats, and fuel to transport personnel and supplies.

Most of our systems depend on cooperators in some form or other. For example, the septic system contractor, Pat Gill appreciated the island hospitality so much that he's now a cooperator, monitoring its performance. The island's communication system is a 3-way partnership. Our most significant cooperator, PRBO, estimates it contributes $2 for every $1 it gets from the Service.

2. Credits

This narrative was written by Joelle Buffa and Jesse Irwin.

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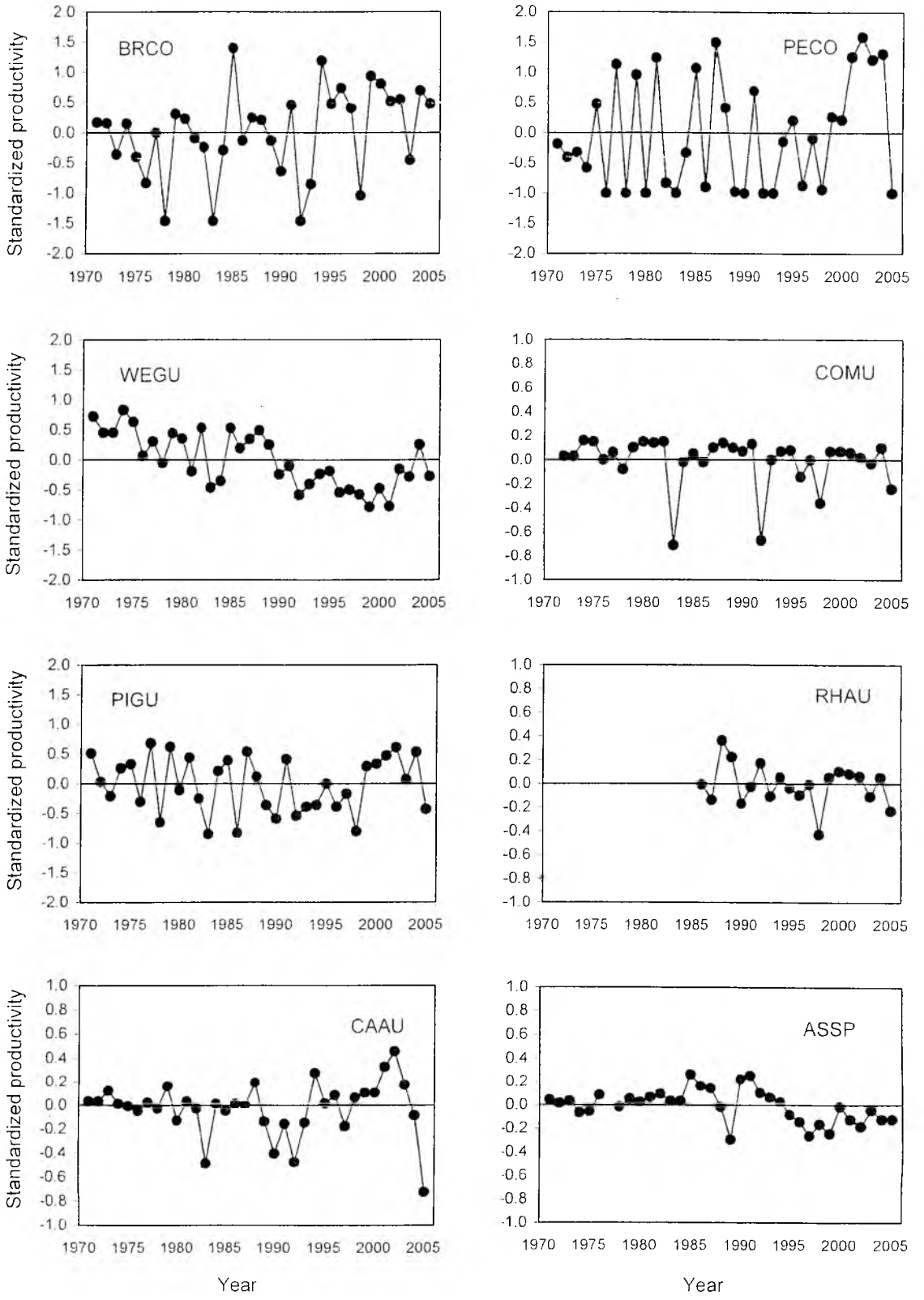

Fig 1 Standardized productivity anomalies (annual productivity - long term mean) for 8 species of seabirds on SEFI, 1971-2005.

FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2003

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2003

Joelle Buffa
Refuge Manager

April 8, 2005
Date

ARBradley
Acting Refuge Complex Manager

4-18-05
Date

INTRODUCTION

Farallon National Wildlife Refuge was established in 1909 and is located approximately 28 miles west of San Francisco. It is comprised of four groups of islands including the North Farallons, Middle Farallons, and Noonday Rock which are all designated as wilderness areas. The South Farallon Islands were given refuge status in 1969 and are the largest group consisting of 120 acres and reaching a height of 370 feet. West End, a portion of the South Farallon Islands, is also designated a wilderness area. The Refuge totals 211 acres.

The Refuge comprises the largest continental seabird breeding colony south of Alaska. It supports 13 nesting species including the world's largest breeding colonies of ashy storm-petrel, Brandt's cormorant, and western gull. Six pinniped species also breed or haul out on the Refuge. After absences of over 100 years, northern elephant seals and northern fur seals returned to breed on South Farallon Islands in 1972 and 1996, respectively.

The Farallon Islands are a granitic formation that is part of the Farallon Ridge. Shallow soils can be found scattered on some of the South Farallon Islands. Vegetation is dominated by Farallon weed, an important nest building material for cormorants and gulls. Floral diversity is limited and is made up of a high proportion and number of nonnative species due to the large amount of human activity on the Southeast Farallon Island (part of the South Farallon Islands) since the 1800's.

Wildlife populations were heavily exploited in the late 18th and early 19th centuries for meat, hides and eggs. Over-fishing of sardines reduced seabird food supplies. Some species were extirpated or declined drastically. Historical estimates indicate that thousands of northern fur seals and as many as 400,000 common murres once populated the islands. An active Coast Guard station further impacted island wildlife and habitat until the full automation of the light station in 1972. Under Refuge stewardship, extirpated species have re-colonized the islands, and wildlife populations as a whole are slowly recovering. Still, wildlife remain vulnerable to the impacts of pollution, oil spills, gill net fisheries and global climate charges. The Service has cooperative agreements with Point Reyes Bird Observatory and the U.S. Coast Guard to facilitate protection and management of the Refuge

TABLE OF CONTENTS

H. PUBLIC USE

A. HIGHLIGHTS

- The trend of general population growth for Farallon breeding seabirds continued for the fifth year in a row, and the common murre breeding population on the Refuge is estimated at approximately 180,000 (Section G.5).

- The Coast Guard removed old diesel tanks, piping and other petroleum waste, north landing boom timbers, and other debris. Most of the work was done by contractors, but a CG staff work party helped clean up debris in August (Section E.5, E.6)

- The Refuge was spotlighted in several unusual ways: The 400th anniversary of the Island's naming was commemorated with a VIP boat tour and Mayoral Proclamation (Section J.2) and an article in the *Fortune Magazine*, profiled the Farallon Refuge Manager (Sec H.1)

B. CLIMATE CONDITIONS

Temperatures are relatively constant throughout the year, seldom falling below 45°F or rising above 65°F. Most rainfall occurs in the winter. Summer moisture is usually limited to damp fog. Offshore fog banks frequently envelope the islands in dense fog.

Moderately heavy winter rains and above average sea surface temperatures (SSTs) in March to May and produced minor El Niño effects: lower food availability, which resulted emaciated sea lions, and lower reproductive success for most seabird species (compared to 2003). Cooler than average SSTs in June and July, moderated the El Niño impacts.

Huge krill blooms were noted around the island in September and October, attended by thousands of birds, particularly Cassin's auklets, and whales.

B. PLANNING

3. Research and Investigation

Farallon NWR is managed by the Fish and Wildlife Service out of the Refuge complex Headquarters. We hold a cooperative agreement with the Point Reyes Bird Observatory (PRBO) for their biologists to be present on the island year-round. They monitor seabirds to determine breeding population size and productivity for 11 species of nesting seabirds, and census number of adult and pups of the 5 species of marine mammals that haul out on the Refuge. PRBO also provides day-to-day resource protection, preventative maintenance, and conducts research approved by the Refuge. The Service provides funding, direction, maintenance support and some assistance for studies.

PRBO studies were numerous, some of which are long term projects that have been on going since the 1970's. They included:

Population demography of the western gull: This study examines survival, breeding biology, and breeding site fidelity in relation to life history traits, reproductive life span, and performance.

Monitoring known-age gulls provides the core of this project. The oldest known-age western gull in this study lived at least 30 years; he hatched in 1971 and continued returning to the island to breed until 2000.

Demography, population dynamics, and food habits of common murre: Four study plots (Shubrick, Upper Upper, Cliff, and Tower) are monitored daily during the breeding season to determine number/location of breeding sites, phenology, breeding success, incubation, and chick-rearing periods. Intensive observations are made of parental care, chick diet, feeding intervals, and foraging trip duration. Diurnal attendance is determined by conducting 3 all-day censuses. Studies of the fish adults feed to chicks have shown that northern anchovy, sardines, and juvenile rockfish are the most important provisioning items. The consumption of juvenile rockfish dominated in the 1970s and 80s, while anchovy and Pacific sardine dominated in the 1990s. Since 2001 juvenile rockfish have again predominant in the chick diet.

Demography, population dynamics, and food habits of Brandt's cormorants: The colony at the Farallons represents the largest single known Brandt's cormorant colony anywhere. Breeding/ productivity studies are conducted at Upper Shubrick and Corm Blind Hill. Reproductive success of known-age birds is being investigated to determine parameters such as age at maturity, fecundity, longevity, mate/site fidelity, survival to breeding age, and how these relate to breeding effort and success. A diet study, initiated in 1983, has shown that midshipman are the most important group in terms of mass, comprising over 50% of the identified diet, although rockfish are the most abundant species-group recorded.

Demography, population dynamics, foraging ecology and diet of pigeon guillemots: Survivorship and parental care is studied by observing color banded birds. Diet watches are conducted at known sites. Observers record site number, band markings, time, and the prey species being taken to breeding sites. Guillemot diet has tracked a pattern similar to murres: During the 1970s and '80s, juvenile rockfish were the primary prey item fed to chicks, while in the 1990s sculpin and flatfish (both bottom fish) predominated. Since 2001, juvenile rockfish and sculpin are the most important components of the chick diet.

Demography, population and diet of rhinoceros auklets: A mark/recapture study was begun in 1987. As of 2003, 738 birds had been banded and previously marked birds had been recaptured 884 times. The objectives of this study are to more accurately determine population size, although data has not yet been analyzed. Birds are mist-netted at four sites, and food items carried in by netted birds are collected and identified. Rhinoceros auklet chick diet shows more variability and less of a pattern than that of murres and guillemots. Occupancy rates and productivity are studied at nesting boxes and natural crevices/burrows.

Demography, population dynamics, and food habits of Cassin's auklets: Age specific reproductive performance and survival, lifetime reproductive success, and recruitment patterns of Cassin's auklets are studied by banding birds and monitoring known-age individuals nesting in artificial nest boxes. Regurgitations are collected to determine food items brought back to chicks. Analysis of diet items since 1994 show krill *(Thysanoessa spinifera* and *Euphausia pacifica)* to

be the main food items.

Colony Formation in Cassin's auklet: This study was initiated in 1990. It was designed to investigate the impacts of western gull predation on Cassin's auklets. Specifically, it addresses the question of whether gulls prevent auklets from colonizing areas which have previously supported high densities of nest burrows. Ten 100 square meter plots are monitored during peak incubation. Occupancy rates of natural burrows in index plots are determined by using a burrow camera.

Population status and productivity of ashy storm-petrel: A mark-recapture study using mist netting, initiated in 1992, continued for the 12th year. Petrels are mist netted and banded at two locations on two nights/month (April through August), weather permitting. To date 3856 ashy storm-petrels (ASSP) have been newly banded (334 of these in 2003) and previously marked birds have been recaptured 730 times (46 recaptured in 2003). A record high of 108 Ashy's (102 new; 6 recaps) were caught on July 25. The goal is to determine population size and assess population trends by comparing results with data sets from1972 and 1992, however data have not yet been analyzed. Leach's storm-petrels are also banded in this study. Productivity of ashy storm-petrels is monitored at known natural crevice nesting sites.

Ashy storm-petrel predation monitoring: Several studies were initiated or continued in 2003 to better document and quantify predation by western gulls, burrowing, and house mice: 1) ASSP wings along the Lighthouse Path (LHH) were collected according to a standardized procedure; 2) Owl pellets were collected from known roosting sites and analyzed (Section G.6); 3) Nest boxes and natural crevices were monitored for signs of mouse predation on track plates, clay eggs and quail eggs (Section G.5); and 4) A low light camera/time-lapse VCR was set up on LHH to record gull predation on petrels. No predation was detected, but the system finally functioned after several years of attempts, failures and equipment modifications.

Tufted Puffin: Breeding population studies did not occur in 2003 because the volunteer who usually conducts them (Elsa Jensen; aka-the "puffin lady") was unable to visit the Refuge.

Black Oystercatcher: Historic nesting sites are monitored.

Reproductive ecology and survival of the northern elephant seal: Multiple objectives focus on the effects of age on reproductive success and the effects of white shark predation on juvenile elephant seal survival. Methods included tagging, marking, and censusing elephant seals during the winter breeding season (Section G.9). Studies have been conducted annually since the Farallons were re-colonized by breeding seals in 1972.

Biology of the White Shark at Southeast Farallon Island (SEFI): This study is being conducted in the waters around the Farallon NWR using the Refuge as an observation point. During fall months (September 1 to November 30) observers conduct all day watches from Lighthouse Hill, collecting data on shark attacks on pinnipeds, and identifying individual sharks by distinctive markings, when possible. Objectives of the study include: 1) determine frequency of predatory

attack; 2) to determine the species and size/age composition of white shark prey; and 3) to mark and re-sight (using photogrammetry) individuals. In 1999 a satellite tagging component was added to track shark movement.

The Fish and Wildlife Service conducted the following studies:

Aerial census of murre colonies - The annual breeding season aerial photographic survey of Farallon colonies took place on May 28, 2003. Colonies are photographed using a 35mm camera, with 300mm lens, shooting out of the bottom of a twin-engine Partanavia airplane. Photographs are taken at an altitude of 800' - 1,000' above the colony. Slides are projected onto white paper and each bird is marked (or "dotted") with a felt pen, and summed for each colony. The Apex-Houston Trustee Council funds this study.

Aerial census of cormorant colonies- The Refuge cooperated with Humboldt State University and Region 1 Office of Migratory Birds (who provided funding) to conduct an aerial survey of all coastal of Brandt's and double-crested cormorant colonies. Images (35 mm slides) were taken at the same time, and using the same methodology, as described for the aerial murre census. Raw nests were counted and used to derive nest counts for all colonies in the state (including the Farallon Islands), and a total state population estimate. This is the first time since 1989 that aerial cormorant counts for the Farallons could be compared to PRBO ground and boat-based counts.

House Mouse population dynamics: A study, initiated in March 2001, to document the population cycle of house mice (*Mus musculus*) on SEFI continued through 2003. Four transects, each consisting of seven trapping sites, are established in various habitat types around the accessible portions of SEFI.. The 28 baited dCon snap traps were set for three consecutive nights twice/month Jan- March, once/month April-August, and twice/month September - December (See Section G-15). After nearly three years of trapping, mice population have been found to peak in October and is lowest in April. This supports other data suggesting that the mice are negatively impacting some of the nesting seabirds, particularly ashy storm-petrels. Kyra Mills of PRBO examined owl pellets collected throughout the year and found that pellets collected in the fall frequently had mouse parts while pellets collected in late winter/spring frequently had seabird parts.

Boardwalk burrow study: A 5-year study, initiated in 2001, of Cassin's auklets colonizing newly created/protected habitat around SEFI buildings continued. Objectives are to quantify the number of auklets nesting under 812 feet of boardwalks, which were constructed in September 2000, and compare burrow density to natural sites. Of particular interest is whether the "auklet friendly" design - gaps between boards to permit auklet passages - are working. 52 burrows were found under the boardwalk in August 2001, 65 in March 2002, and 104 were located in August of 2003. A subset of the burrows were sampled for occupancy each year. Twelve (67%) of the 18 burrows sampled in August 2003 were occupied by Cassin's auklet, though rhinoceros auklets also use burrows under the boardwalks. Three of the boardwalks, which were purposefully built without "auklet gaps"because they are used for mist-netting, have significantly fewer burrows excavated under them.

The Refuge occasionally issues permits to other researchers to conduct studies. During 2003 these included:

Intertidal communities within GFNMS Monitoring:
In 1992 GFNMS biologists began monitoring the density and diversity of intertidal species (invertebrates and algae) at six locations on Southeast Farallon Island. Point and photo quadrants are visited three times annually (February, August, November). The purpose is to develop baseline species inventory to determine resource risk and damage assessment in the event of an oil spill or other human-induced of natural disaster. Average percent cover of study sites ranged from 86% - 236% in 2003.

Evaluation of house mouse diet on Southeast Farallon Island
Andrew Hagen, a Humboldt State student, identified prey remains in mice stomachs collected from February 2002 to March 2003 to further our understanding of the house mouse interactions. Stomach contents from a sub-sample of mice collected during the USFWS population dynamics study (n=57) mice were analyzed. Preliminary results of this first-ever diet study of Farallon mice is revealing (see Section G.15 for results), but incomplete. No mice were available for the months of April-August for analysis. Attempts will be made during 2004 to fill this data gap.

E. ADMINISTRATION

1. Personnel

PRBO began preparing for changes in the Farallon Biologist staff. 2003 marked the final (and 26th year) of Jerry Nusbaum's rein as Farallon Winter Biologist. Derrick Lee, who will replace him in winter 2004, spent several weeks on island learning the winter season ropes of elephant-seal monitoring, water harvest, battery cleaning, and floor waxing. Jerry was "lunched" by the Refuge staff in May and received several retirement gifts, including the gold watch he always hoped for. Peter Pyle, who was a Farallon biologist for many years, left PRBO in November. Gratefully, Adam Brown and Russ Bradley/Pete Warzybok intend to continue their great work during the fall, and spring/summer seasons.

Jesse Irwin (pictured) began as the new FWS Farallon ROS in May 2003. He quickly made his mark on Farallon facilities and habitat, completing the Refuge's first weed management plan and installing an electric start on the Lister generator. Fears that Farallon biologists would become flabby from lack of hand-cranking the generator did not come to pass, since derrick repairs and Webasto breakdowns provided other opportunities for aerobic exercise.

4. Volunteer Program

During the Calendar year 2003, approximately 14 volunteers donated about 9,144 hours of service to activities supervised by PRBO on Southeast Farallon Island. Volunteers assumed a variety of responsibilities including assisting with bird, mammal, and white shark monitoring; research; collecting meteorological and oceanographic data; and performing facility and equipment maintenance.

Two Refuge volunteers (Karen Vickers and Andrew Hagen) donated approximately 166 hours during 2003, conducting non-native plant control and mouse trapping activities.

5. Funding

The cooperative agreement between the Refuge and PRBO provides PRBO with an amount equivalent of one GS-7 and one GS-9, plus benefits (20%), and camp rate per diem for two persons. A total of $98,934 was paid to PRBO in 2003.

R1 Migratory Birds (Portland) funded Island Conservation and Ecology Group $5,000 to prepare a Farallon Mouse Eradication Plan and Proposal.

Roy Clark, Environmental Officer for the US Coast Guard, secured approximately $220,000 to fund removal of the old diesel tanks, piping and other petroleum waste, north landing boom timbers, and other debris.

Annual funding continued from the Apex-Houston Trustee Council for boardwalk monitoring ($2,040) and the Cape Mohican Trustee Council for non-native plant control ($25,000). These sources, along with Storm Relief carry-over dollars from 1998, funded the Farallon ROS salary.

Refuge Cleanup Funds provided $6,045 to complete color infra-red orthophoto quad and digital images of the South and North Farallon Island (Figure 2).

3. Safety

The passive, in situ clean-up of contaminated soils behind the Powerhouse continued. The aerators installed by Geo Engineers in October 2002 continue to spin during windy days. Soil samples taken in November showed that petroleum was dissipating as planned.

Bricks from an old chimney were removed from the attics of the residence house (n=225) and Coast Guard House (n=150) to prevent them from crashing through the bedroom ceilings. The above-roof portion of the chimneys were removed in 1999; the portion below the roof remained but the mortar had disintegrated to sand and dust, creating a potential safety hazard.

Pete Warzybok takes Safeboat for a spin

Safety improvements continue to be made at East Landing. The derrick received its annual inspection and load testing in January. A contractor (AC3) performed annual maintenance and another inspection/testing in September. In October, a 15' Safeboat with 50 hp motor replaced the Boston Whaler as the East Landing shuttle boat. The boat was designed to meet OSHA standards for a personnel lifting device, with safety rails, rated harness and hardware, and other features.

In August, a 5-person Coast Guard work party collected, cut-up and stacked 1,000 feet of old water pipe and other debris in preparation for a hazardous material removal. In October, Coast Guard-hired contractor (Brittany Construction) completed the removal. In addition, two 5,000 gallon diesel tanks, hundreds of feet of petroleum-contaminated piping, conduit and wire from a toppled radio antennae, and timbers from a boom dismantled last year were removed by a helicopter/boat operation. Approximately 575 gallons of diesel/water contaminants were also pumped from the tanks into bladders and removed from the island. The cement containment berm around the tanks was demolished so that it no longer poses a bird drowning hazard. Removing the old, corroded diesel storage system reduced the chances of a spill occurring on the Refuge. *Out and About*, Region 1's newsletter, featured an article about clean-up project.

F. HABITAT MANAGEMENT

1. General

The Refuge consists of 211 acres of mostly rocky habitats. SEFI, where all facilities and staff are located, supports a soil-covered marine terrace. Island flora includes 45-50 species. Rocky habitats provide nesting areas for many seabird species including common murres, pigeon guillemots, and Brandt's cormorants. Soils provide habitat for burrow-nesting species such as Cassin's and rhinoceros auklets. Rocky habitats are largely undisturbed. However, habitats which can support plant life on SEFI have been significantly impacted by a history of human occupation and disturbance. Many exotic plant species flourish on the island, and in some areas have displaced the native endemic Farallon weed (*Lasthenia maritima*). *Lasthenia* plants were collected in April and sent to Mike Vassey of San Francisco State University, who is looking at differences in nutrient uptake between Farallon plants and those found on the mainland.

3. Forests

The "woodland habitat" on SEFI consists of three Monterey cypress and one low-growing Monterey pine, which are able to tolerate the strong prevailing winds. These small trees serve as veritable magnets to migrant land-birds. During the spring and fall large numbers of migrants can be found in and around these trees, thus facilitating censusing and banding of these birds.

6. Other Habitats

In 2000, a "Habitat Sculpture" containing 32 nesting boxes and an observation blind, was constructed near North Landing by Meadowsweet Dairy. Concrete blocks were stacked upon one another in an design engineered to create habitat for crevice nesting birds. In the first year (2001), 9 of the 32 available sites were occupied by Cassin's auklets. In 2002 and 2003, 12 and 16 Cassin's auklet pairs, respectively nested in the sculpture, as well as 1 pair of pigeon guillemots.

10. Pest Control

FWS personnel and PRBO and volunteers continued to control exotic vegetation, primarily New Zealand spinach (*Tetragonia tetragonioides*) and cheeseweed (*Malva spp.*), to prevent its encroachment into new areas and reduce its spread in already-infested areas where it covers seabird nesting burrows. August 10-16 marked the 15th year in a row that Refuge staff chemically treated spinach and *Malva spp.* with a 4% Round-up herbicide solution after the seabird breeding season.

The infestation of spinach and Malva increased dramatically from the past year. The amount of chemical used and the number of hours need to apply the herbicide doubled when compared to 2002. The chart below illustrates the herbicide used since 2001. Weather patterns that produced late season rain and the absence of a Farallon ROS for much of the year are suspected culprits for the abundance of weeds on the island in 2003.

Year	Gallons (4% Round-Up)	Hours to Apply
2001	179	52
2002	163	46
2003	328	98.5

Refuge staff and volunteers spent 177 hours pulling spinach and Malva plants throughout the year except the breeding season. PRBO also contributed by pulling weeds as time allowed. The Refuge continues to use Cape Mohican oil spill funding, and station fund when available, to control invasive species to combat invasive species.

A Farallon ROS was hired in May and began assessing strategies for an improved weed control program. A weed management plan was initiated in the fall (completed in Feb. 2004) to address the various weeds and methods available for control. In addition to spinach and Malva, plantain (*Plantago coronopsus*) and grasses (multiple species) are major weeds degrading habitat. Seed collection of Farallon weed (*Lasthenia maritima*) was initiated to help suppress invasives in areas mechanically cleared of weeds.

3. Wilderness and Special Areas

In 1973, Middle Farallon Island, North Farallon Islands, West End (part of the South Farallons), and Noonday Rock were designated a National Wilderness Area. The largest island, Southeast Farallon, was excluded from this designation because of the structures and people living on the island. The Wilderness Area encompasses 141 acres, which serve as marine bird and mammal breeding areas. Periodic monitoring from offshore by boat or by foot is the only management practiced on these islands, therefore the wilderness designation does not affect Refuge operations, and visa versa.

The waters surrounding the Refuge are part of the Gulf of the Farallones National Marine Sanctuary, managed by NOAA. The islands and surrounding waters are designated by the state as the Farallon Islands Game Refuge, and are part of the Golden Gate Biosphere Reserve. The Farallon Islands have been designated as a Globally Important Bird Area by the American Bird Conservancy.

G. WILDLIFE

2. Endangered and/or Threatened Species

Table 1. Peak monthly population estimates of California brown pelicans on S Farallon Island

Month	1995	1996	1997	1998	1999	2000	2001	2002	2003
January	52	320	475	1000	700*	200*	1050	50*	237
February	0	N/A	38	525	500*	6	20*	1*	100*
March	81	14	0	213	0	65	83	0*	158
April	73	7	1	180	0	26	34	6	0
May	14	10	40	455	26*	42	48	9	24
June	5*	10	386	1245	41	436	118	5	48
July	464	193	112	300*	300*	300*	238	181	24
August	1200	456	960	810	500*	300*	307	143	160
September	1190	819	3380	2332	728*	1700	970	445*	680
October	1629	1670	4350	2625	2700	2450	1350	925	1375
November	1117	721	3030	2360	1900	663	800	1200	1140
December	392	460	1500	750*	1000*	650	500	500	916

*** =Average monthly population** **N/A= Data not available**

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

a. California Brown Pelican

Brown pelican numbers peaked at 1375 in October (Table 1). The timing of this peak was characteristic of most years, as pelican use is usually concentrated in the fall and winter when birds commonly roost on the islands after dispersing from breeding sites in Southern and Baja California. Year to year fluctuations in numbers are related to water temperature (more pelicans during warm-water years), and the relative abundance of food resources in coastal and offshore zones.

b. Steller Sea Lion

The Steller sea lion was listed as federally threatened in 1990 due to a 50% worldwide decline between the 1960s and 1989. The South Farallon Island (SFI) rookery and waters around the Refuge are designated critical habitat. Most of the following is based on Hastings and Sydeman (2002).

Counts of Steller sea lions on the Farallon Islands have been conducted since 1927, however standardized annual counts on SFI have occurred only since 1973. The Steller sea lion population has declined on SFI between the 1920s and the present. However, the magnitude and pattern of the decline is complicated by differing census techniques and differing patterns in seasonal trends, age-classes and sexes. The total count of Steller sea lions on the Farallon Islands has declined approximately 80%, from an average of 790 animals from 1927-1947, to an average of 150 animals from 1974-1997. This may be biased because animals on North Farallon Islands were not included in surveys since 1950.

Between 1974 and 1996, numbers of adult females during the breeding season declined approximately 6% per year and maximum pup counts also declined significantly. During this same period, numbers of sub-adult males increased during the breeding season, and numbers of immatures present during the late fall/early winter increased by approximately 5% per year.

A shift in pupping areas on the SFI occurred from 1973 to 1988. From 1973 to 1975 all full-term pups were born on Saddle Rock. From 1976 to 1983 females pupped in Sea Lion Cove, but this site was abandoned in the late 1980's, possibly due to increased diving activity. Pupping was first observed on West End in 1985. Shell Beach and Indian Head on West End are currently the only active rookery sites on SFI.

Steller sea lion natality rates have also declined steadily between 1973 and 1994, exhibiting a low pregnancy rate and high incidence of premature pupping (stillbirths). The premature pupping rate on SFI (30-50%) is extremely high compared to others rookeries (e.g. 2% at Año Nuevo). Twenty to thirty pups were born annually in the late 1970s and early 1980s, compared with an average of five to ten per year in recent times (Table 3). Although pup production may be somewhat underestimated because rookeries are not easily observed from island vantage points, low pup production is evident- only 11% of females give birth on average. With such low reproduction, the status of the Steller sea lions at Farallon NWR remains precarious.

Possible reasons for the SFI Steller sea lion population decline include pollution, human disturbance, over-fishing, increased disease and/or predation on sea lions, and El Niño effects. PRBO's annual monitoring suggests that the 1982-83 El Niño may have affected the number of viable pups cows were able to produce. Studies of possible causes of premature births found that five to seven premature pups sampled died of the influenza virus, and a pollution study found elevated organochlorine and trace metal (Hg and Cu) levels in sea lion tissues. It has been suggested that there may be an interrelationship between increased levels of organochlorines and PCBs and diseases.

3. Waterfowl

Waterfowl are not common on SEFI. Most records consist of duck or goose flocks flying by the island. The Refuge's most treasured fowl is Molly, a black brant that has been a resident on SEFI since 1993. We try not to remind her that she's a goose, as she thinks of herself as one of the western gull gang of that she hangs out with on the marine terrace. Molly disappeared for the last half of 2002, and all were relieved when she reappeared January 31, 2003. Her where-abouts during this and another 3-month disappearance in spring 2004 remains a mystery.

4. Marsh and Waterbirds

No marsh or waterbirds breed on the Refuge, however PRBO counts wintering and migratory species daily. Black turnstones, willets, whimbrils, and wandering tattlers are commonly seen. Occasionally, rareties show up in fall or spring. In September, 10,000 red-necked phalaropes and 30,000 red phalaropes were counted migrating past the island during a 3 day period.

5. Gulls, Terns and Allied Species (Seabirds)

Farallon NWR is an extremely important breeding site for seabirds. It supports 29% of the breeding seabird population in California and is the single largest seabird breeding colony in the continuous United States. A statewide survey of seabird colonies conducted by the USFWS in 1989-1991 found that the North and South Farallon Island colonies contained the largest seabird population in California, totaling 155,550 breeding birds of 12 species (plus another possibly breeding species). Breeding birds have increased to over 250,000 since then.

The Refuge supports a significant proportion of state's breeding population for 10 species: Leach's storm petrel (11%), ashy storm-petrel (55%), double crested cormorants (11%), Brandt's cormorant (25%), western gull (36%), common murre (19%), pigeon guillemot (12%), Cassin's auklet (68%), rhinoceros auklet (29%), and tufted puffin (25%). The Refuge hosts the world's largest colonies of ashy storm petrel, Brandt's cormorants and western gull, as well as the most southerly colonies of significant size for rhinoceros auklets and tufted puffins on the west coast of North America.

Seabird breeding activities on the Farallon Islands are correlated with the seasonal occurrence of oceanic upwelling off central California. Extended periods of strong northwesterly winds during late winter and early spring promote the upwelling of cold, nutrient-rich subsurface waters.

Upwelling stimulates phytoplankton blooms and production of zooplankton and juvenile fish, including sardines, which are the prey-base for the seabirds of the Refuge. Juvenile sardines, an important part of the seabird diet, were over fished in the 1940s and disappeared from the Farallon food chain. Juvenile sardines returned to Farallon waters in the early 1990s.

Seabird populations and productivity of 11 species were monitored by PRBO by cooperative agreement and results are shown in Table 2 below.

El Niño conditions during the winter of 2002/2003 resulted in an unusual season for seabirds on SEFI in 2003. The sea-surface temperature (SST) was anomalously warm in the early part of the breeding season, but cooled in June and July, positively affecting prey availability during the peak of chick rearing. Thus, this El Niño had more moderate effects on productivity of Farallon seabirds than the previous El Niños of 1998, 1992, or 1983.

Productivity during the 2003 breeding season was lower than 2002 for all species, and lower than the 10-year average for all species except pigeon guillemots, Cassin's auklets, and pelagic cormorants. In addition, 2003 was characterized by delayed breeding relative to the previous two seasons, a high rate of nest abandonment among Brandt's cormorants, and a reduction in the proportion of rockfish in the chick diet. Lack of food during the winter and spring months could also explain the large numbers of emaciated sea lions observed around the island this season. Some individuals had a direct impact on seabirds by crawling into the colonies, causing disturbance and actively preying on murre chicks. Additional chicks and eggs fell prey to gulls who took advantage of the melee.

Population estimates for almost all species were higher in 2003 than 2002 (Table 2), continuing a trend of general population growth for Farallon seabirds over the last four years. This is particularly encouraging considering the moderate El Niño experienced this year

In 2002 the **ashy storm-petrel** was identified as a "Bird of Conservation Concern" by the USFWS. Birds on this list represent the Service's highest conservation priorities. Without additional conservation actions , these birds are likely to become candidates for listing under the Endangered Species Act. PRBO analyzed population viability for the ashy storm-petrel in 1998. This analysis concluded that the population is not in imminent danger of extinction, but should be considered threatened; population viability is a concern.

The SEFI **ashy storm-petrel** breeding population was estimated at 2661 for 1992 by PRBO from capture/recapture data (Sydeman et al. 1998). A population estimate of ashy storm-petrels more recent then 1992 cannot be made until data from continuing mark/recapture study are analyzed. Comparing 1972 and 1992 population estimates shows 35% - 40% overall population decline of breeding birds. The 2.87% per year decline roughly equals the number of predated ashy storm-petrel carcasses observed annually. This predation rate on adults of such long lived, slowly reproducing species is considered significant. Gulls and burrowing owls are the main predators. Storm-petrel productivity has also declined in the past decade, but reasons for this are unknown.

Table 2. South Farallon Breeding Seabird Populations

	1997		1998		1999		2000		2001		2002		2003		1993-2002
SPECIES	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF[6]**	**BP**	**YF[6]**	**BP**	**YF[6]**	**Avg. Breeding Population**
Ashy storm-petrel [1,2]	2,661[3]	0.78[6]	2,661[3]	0.52[6]	2,661[3]	0.74[6]	2,661[3]	0.67[6]	2,661[3]	0.56[6]	2,661[3]	0.55[6]	2,661[3]	0.64[6]	N/A
Double-crested cormorant	188[5]	N/A	330	N/A	468	N/A	402	N/A	402	N/A	486	N/A	392	N/A	443
Brandt's cormorant[1]	7,490[5]	7,003	5,092[5]	1,069	6,345[5]	7,614	5,896[5]	6,692	6,570	6,504	9,466	9,513	11,222	5,667	7,595
Pelagic cormorant	316[5]	144	164[5]	5	222[5]	141	260[5]	159	416	470	442	572	510	564	349
Black oystercatcher	22	14	18	10	30	26	26	N/A	30	6	22	10	26	14	20
Western gull[1]	23,807	7,142	19,707	5,124	19,767	3,063	15,544	4,818	18,235	2,918	15,095	7,095	16,838	6,819	19,906
Pigeon guillemot	1,273	433	294	7	468	267	568	335	502	331	499	365	500[7]	230[7]	719
Common murre	61,089[5]	24,130	52,670[5]	10,271	58,878[5]	24,082	53,301[5]	21,853	68,194[5]	27,619[4]	103,588	39,881[4]	107,105	38,558[4]	64,124
Cassin's auklet[2]	26,892	7,395	10,458	4,131	15,239	6,324	15,239	6,324	16,690	8,762	18,807	11,096	23,692	10,661	20,131
Rhinoceros auklet[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.66[6]	N/A	0.64[6]	N/A	0.62[6]	N/A	0.45	N/A
Tufted puffin	130	N/A	50	N/A	118	N/A	74	N/A	102	N/A	128	N/A	N/A	N/A	103

*BP= Breeding population; YF= Number of young fledged; N/A= Data not available.

(1) Farallon National Wildlife Refuge contains the world's largest breeding colony for species.
(2) Estimates from Southeast Farallon Island only.
(3) 1992 Estimate (Sydeman et al 1998). More recent population estimate not available.
(4) Murre chicks fledged/pair based on pooled data from 3 productivity plots.
(5) Population estimate from land based survey only. No boat survey conducted.
(6) Young fledged includes relays. For ashy storm-petrel and rhinoceros auklets, figure is young fledged/pair.
(7) Pigeon guillimot data from evening raft counts. Using morning raft counts, population estimate = 2,383 & young fledged= 1,096
NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite

It is suspected that introduced house mice are indirectly responsible, in part, for petrel declines. The high fall mouse population entices some migrating burrowing owls to over-winter. When the mouse population crashes, starving owls turn to storm-petrels as a food source. Studies are currently underway to better understand this interaction and plan management actions to reduce the conflict (Sections D.5, G.15).

The population of **Brandt's cormorants** breeding on South Farallon Island has declined since the 1970s, when the breeding population exceeded 20,000 birds. By the mid 1980s, a large drop in breeding population size occurred after the strong 1982-83 El Niño. Since the late 1980s, the Brandt's population has fluctuated, but PRBO population estimates have never exceeded 11,000 birds until this year (11,222, Table 2). The Service and Humboldt State University conducted a survey of all coastal Brandt's and double-crested cormorant colonies in 2003, and compared them to 1979-80 and 1989 surveys (Capitolo et al. 2004). They found that the central California Brandt's population was 38% higher in 1989 than in 1979-90, demonstrating population growth at the same time as the drop at South Farallon Islands. They concluded that birds moved from the Farallons to colonies south of Monterey Bay (in the mid-1980s), and later (in the mid 1990s) to new colonies that formed at Año Nuevo and Alcatraz Islands. Still, the Farallon Brandt's colony remains the largest in the world, and contains 25% of California's breeding birds.

The population estimate on Table 2 was based on a total of 5,611 well-built nests counted during PRBO ground surveys conducted June 9 and 10, and a boat survey conducted June 5. Capitolo et al. 2004 counted 6,801 and 98 nests, respectively on South and North Farallon Island during May 30 (South) and May 28 (North) 2003 aerial surveys. This indicates a larger South Farallon Island population of 13,602 (6,801 nests x 2 birds per nest), and a total Refuge population of 13,798. Captitolo et al. concluded that aerial counts give more accurate numbers. Regardless of the exact numbers, the population has grown substantially over the past 3 seasons due to survival and recruitment of young to the colony. However, productivity in 2003 (1.01 fledglings per pair) was much lower than the 32-year mean.

The **double crested cormorant colony** is located on Maintop on West End. On 21 May, a peak number of 196 well-built nests with birds in incubation posture were counted. Multiplying this count by 2 yields a breeding population of 392 birds. This estimate is 20% lower than 2002, and 11% lower than the 10-year average (Table 2). Captitolo et al. counted 439 nests on 28 May 2003, which would yield a population of 878. While aerial methods may more accurately portray population numbers (Captito et al. 2004), PRBO counts more accurately portray population trends since they are conducted the same way each year. No reproductive data is collected on this species due to poor visibility of double crested cormorant nests.

The **pelagic cormorant** breeding population was 46% higher than the 10-year average. The estimated 2003 breeding population of 510 birds was 15% higher than the 2002. Ground census was conducted on June 9 and 10, and the boat portion was completed on June 5. Pelagic cormorants have declined substantially over the past two decades. Although populations have grown considerably over the past three seasons, numbers remain well below those observed in the 70s and 80s. Cormorants produced 2.21 fledglings per pair, which was well above the long-term mean productivity for this species.

By Tom Goodier 1/8/1994. Redwood City

The **western gull** breeding population size of 16,838 birds was 11% higher than in 2002 but still 15% below the 10-year average (Table 2). Western gull populations and productivity has shown a steady decline over the past decades (Fig. 1). Productivity in 2003 was down about 14% compared to 2002, but still among the highest observed over the past ten seasons. Changes in prey availability and intra-specific predation are hypothesized factors for the decline.

Tom Goodier, San Francisco Bay Bird Observatory, reports seeing this adult western gull each winter in Redwood City (south San Francisco Bay) since December 26, 1992, and most recently on February 27, 2003. The metal FWS band and black cohort band identify it as a Farallon chick banded in 1982. There is no record of it breeding in SEFI plots.

The peak count of 500 **pigeon guillemots** on 19 April was approximately equal to 2002 and 2001, but 30% lower than the 10-year average (Table 2). This breeding population estimate was derived by counting adults rafting on the water around SEFI at dusk through the month of April, before the birds begin attending their nesting sites. This methodology is consistent with how previous population estimates shown on Table 2 have been made. However, over the last two seasons, much higher numbers of guillemots have been counted on the water in early morning, prompting the initiation of early morning raft counts. The peak morning count of 2,383 pigeon guillemots was an increase of 21% compared to the peak morning count of 2002. This number is similar to the peak numbers observed around the island in the late 70s and early 80s, but based on different methodology.

Pigeon guillemots were monitored at 141 sites on Lighthouse Hill, Garbage Gulch, and the Habitat Sculpture, of which 96 were observed with at least one egg (68% of total monitored sites). One nest was located in the habitat sculpture, for the second year in a row. Productivity fell considerably this year compared to the previous four years, with only 0.92 fledglings produced per pair. This is 44% lower than last season but still 10% higher than the 32-year average (Fig. 1).

The South Farallon Island **common murre** 2003 population estimate of 107,105 (Table 2) was 3% higher than 2002, and well above the 10-year average. This estimate is derived from land-based surveys conducted by PRBO in late May/early June, and a correction factor to account for the proportion of the population that would normally be censussed from the boat. The boat portion of the survey was not conducted this year due to unfavorable weather conditions.

Aerial surveys conducted by USFWS on 28 May came up with the following murre breeding population estimates: South Farallon Islands = 115,240; North Farallon Islands = 65,046. These estimates were derived from applying a correction factor of 1.50 (used for PRBO's population estimate) to the raw numbers counted: 76,827 and 43,364, respectively for South and North Farallons. These numbers are preliminary and may change upon further analysis (McChesney et al.2004).

The South Farallon island production estimate of 38,558 fledglings is based on productivity data pooled from three plots (Upper Shubrick Point (USP), Upper Upper and X); previous years' fledgling data were extrapolated from the USP plot only. Warzybok et al 2003 contains more details on seabird populations and reproduction.

An emaciated juvenile sea lion terrorized the Shubrick murre colony for multiple days in June. He struggled up the steep rocky hill from the water and hauled-out in various sub-colonies, causing death and destruction in his wake. Flustered adult murres dislodged eggs, and un-attended chicks and eggs became prey for gulls. The sea lion learned how to eat murre chicks, grabbing them in their jaws by the head and beating their bodies on the rock until they looked like a limp fish (with down). The disturbance resulted in at least 30 lost eggs and 50 lost chicks. The sea lion was named Zalophusaurus Rex.

The SEFI **Cassin's auklet** breeding population estimate is considered very rough, and is based on counts of burrows and crevice nesting sites. Population censuses are very difficult due to the bird's nocturnal behavior and burrowing nesting habits. The most recent complete survey of all burrows and crevices on South Farallon Islands conducted by USFWS in 1989 produced an estimate of 29,880 breeding birds on SEFI (38,274 for all South Farallon Islands). A burrow occupancy rate of 75% was used as a correction factor. Since 1991, PRBO has monitored Cassin's auklet burrows and crevices in twelve index plots on SEFI in order to detect population trends. The difference in index plot burrow density each year is applied to the 1989 USFWS population estimate to roughly estimate the current year's population. The SEFI 2003 breeding population was estimated at 23,692 birds. This is 26% higher than 2002, and 18% higher than the 10-year average. (Table 2).

Cassin's auklets on the Farallon Islands have been declined considerably since 1971, and although Cassin's have increased steadily in past 4 years, they are just now approaching numbers observed prior to 1998. Productivity for this species has been high for the past 5 years, and we hope this trend to continue as long as favorable oceanographic conditions and prey persist.

Occupancy of breeding Cassin's auklets in boxes was high again this year, with 91% of the 44 boxes occupied. Productivity, while down from the past two seasons, was still high with 0.90 chicks fledged per pair (including second broods and relays- See Table 2). This is 24% higher than the 32-year average. Some monitored birds successfully raised second broods.

Rhinoceros auklet population size could not be estimated due to difficulties in censusing this crepuscular, burrow-nesting species. Rhinoceros auklet pairs bred in 30% of 152 monitored sites (boxes, crevices, and cave sites). Auklet productivity has remained low despite improved oceanic conditions, and is usually 10-15% below Año Nuevo. Auklets produced 0.45 fledglings per pair, which was 27% lower than last year and 20% below the 17-year average (Fig. 1).

Tufted puffin breeding population estimates were not made in 2003. Puffins were observed in their normal locations and seen carrying fish to their burrows, but no attempt was made to

conduct a full census. Productivity cannot be estimated due to the inaccessibility of nesting crevices.

Black Oystercatcher breeding population is estimated by censusing all known breeding sites visible from Lighthouse Hill and the Marine Terrace. The estimate does not reflect birds on parts of the islands not visible from the SEFI vantage points. Of the 31 sites that were monitored this year, 16 were attended by a breeding pair which had eggs and/or chicks. This estimate is 18% lower than last season, and 30% higher than the 10-year average (Table 2). Oystercatchers produced 1.1 fledglings per pair, equal to that observed in 2002. Black oystercatcher nests are cryptic and difficult to observe, therefore clutch size and hatching success could not be estimated.

Oiled Birds: During the 1990s and early 2000s, winter storms coincided with large numbers of oiled birds found washed ashore or swimming in waters around the Farallons Islands. In 2002 the source of this oil was finally discovered, and 100,000 gallons of oil were removed from the SS Luckenbach a sunken ship southeast of Farallon Islands. Approximately 75,000 gallons remain in the Luckenbach, deemed too dangerous to extract. During November and December 2002 over 100 oiled birds were observed from the island, and many more oiled seabirds washed up on the mainland, raising concerns that oil left "sealed under sediments" in the Luckenbach's tanks continued to pose a wildlife threat. It was a relief, therefore that a total of only 18 oiled birds were recorded during the entire year of 2003. Most of these (10) were common murres; 7 oiled western gulls and 1 Cassin's auklet were also observed.

6. Raptors

One or two peregrine falcons were present throughout the winter, early spring, and fall months (Jan-Mar and Aug-Dec). Peregrine falcons feed primarily on Cassin's auklets and common murres at sea near SEFI, based on numerous carcasses found at island feeding sites.

One burrowing owl was present January through March. It fed on ashy storm-petrels and auklets as evidenced by disarticulated wings found near its roost. Attempts to capture and transport it off the island failed. It is assumed to have died sometime in March, because it was not seen in April or thereafter. This is typical of most owls that overwinter. After the mouse population crashes, they turn to seabirds as a food source, after which they either starve or are killed by gulls. Capture, banding, and release studies have shown these to be young-of-the-year birds. They are most likely dispersing juveniles that arrive during fall migration and stay because of the abundant food supply (non-native house mice peak in the fall). Another burrowing owl was present August through December.

Ashy storm-petrel wings near burrowing owl roost

A growing concern is that wintering burrowing owls (and to a lesser extent other owl species) begin preying on ashy storm-petrels and Cassin's auklets (2 declining seabird species) once the mice are hard to find. This prey switch has been confirmed by analysis of owl pellets collected form SEFI roosting areas. Between August and March, mice compose a higher percentage of pellets (>85%), with a lower incidence of petrels, auklets, and insects. Between April and July, when mice are scarce or more difficult to find, and more seabirds are found on the island, the incidence of birds in pellets increased to nearly 70%.

7. Other Migratory Birds

Although there are no resident landbirds on the Refuge, Southeast Farallon Island is well known for the number and diversity of landbirds that arrive on the island during spring and fall migrations. Many of these landbirds are common western birds, however, the birds that attract the most attention are "vagrants", common elsewhere in the US or other countries, but not normally found on the west coast or in California. Most vagrants that have been captured and aged on the Farallon Islands are juvenile birds. Over 400 species of birds have been recorded for the Farallon Islands.

Species and individuals are tallied daily (year-round) by searching the few areas frequented by landbirds, and mist nets are operated between mid-August and early December to determine the numbers of arrivals and how long they stay. Weather patterns were responsible for a slower than average fall migration during 2003, however many typical vagrant species were observed. The rarest landbird species that visited SEFI this fall were Connecticut warbler, painted bunting, snow bunting, and Baird's sparrow, the later being only the 4th state record for this species.

9. Marine Mammals

Weekly all-island pinniped counts of haul-out areas on South Farallon Island (SFI) are conducted throughout the year. Maximum populations and breeding success for the five pinniped species using the South Farallon Island during the last nine years are shown in Table 3. Average monthly numbers of pinniped populations for the past three years are shown on Table 4.

Guadalupe fur seal sightings are not included on Table 3. One or several animals have been observed each year in early fall or winter since the first historic sighting of this species in September 1993.

The National Marine Fisheries Service Southwest Fisheries Sciences Center analyzed pinniped population trends in the Gulf of the Farallons during the period 1973 to 1994. Some of the following discussions is based on the report prepared by Sydeman and Allen (1996).

California sea lions, primarily immatures, haul-out on SFI year-round. They are the most abundant species of pinniped on the Refuge. Sea lions numbers increased significantly at SFI between 1973 and 1994, at an average rate of 6.4% per year. Peak California sea lion abundance was observed in the years of the 1983, 1992, and 1998 El Niño Southerly Oscillation (ENSO)

Table 3.-(A) Maximum Population Numbers (Peak Monthly)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
California Sea Lion	3416 (May)	4594 (May)	4303 (Aug)	4990 (July)	7837 (Oct)	5270 (Jan)	2423 (Sept)	3301 (Aug)	4480 (June)	5630 (Feb)
Steller Sea Lion	187 (Oct)	138 (June)	213 (Nov)	148 (Nov)	253 (Dec)	133 (Oct)	174 (July)	261 (May)	304 (Nov)	373 (Mar)
Harbor Seal	122 (Feb)	151 (Mar)	144 (Sep/Oct)	141 (Sept/ Nov)	190 (Feb)	125 (Feb)	128 (Dec)	150 (Dec)	168 (Jan)	180 (Jan)
Northern Elephant Seal	838 (Apr)	532 (Apr)	590 (Jan)	571 (Nov)	406 (Jan)	623 (Nov)	1019 (Nov)	843 (Oct)	736 (Nov)	1009 (Nov)
Northern Fur Seal	2 (Mar)	3 (Aug)	10 (Aug-Oct)	8-12 (Sept)	4 (Nov)	22 (Aug)	13 (Sept)	18 (Sept)	35 (Sept)	22 (Sept)

Table 3.-(B) Number of Pups or Pups/weaners Produced

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
California Sea Lion	2	3	16	0	31	17	33	12	13	48[4]
Seller Sea Lion[1]	5	5	5	4	10	11	9	11	7[4]	13[4]
Harbor Seal	N/A	1	1	2	4	2	1	1	3	2
Elephant Seal[2]	287/183	299/188	308/232	274/211	250/192	198/158	174/127	156/139	136/115	149/109
N. Fur Seal[3]	0	0	1	4	1	3	4	5	13	8

N/A= Data not available

[1] Maximum numbers of pups observed during any one June/July census.

[2] Number of pups born/number pups weaned

[3] Number of pups observed during August visit to West End, except if otherwise noted

[4] Number of pups counted by NMFS aerial census

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

Table 4. Average Monthly Pinniped Numbers - South Farallon Island

	CA Sea Lion			Steller's Sea Lion			Harbor Seal			Elephant Seal			N. Fur Seal		
MONTH	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**	**2001**	**2002**	**2003**
JAN	1500	1750	1000	43	50	155	125	168	180	275	275	160	1	1	0
FEB	750	1000	4500	20	35	40	100	150	150	225	182	150	0	2	0
MAR	570	320	2604	31	24	55	108	125	72	157	110	130	0	1	0
APR	340	1084	1808	50	95	75	96	64	57	468	451	488	0	0	0
MAY	1428	3393	2436	132	104	94	70	57	77	390	347	427	0	1	0
JUNE	1452	3760	3995	108	93	70	85	81	80	73	46	65	5	2	2
JULY	2439	2600	3289	92	70	43	74	95	80	24	20	12	6	3	1
AUG	2985	1388	3014	63	13	29	79	57	58	53	47	52	0	1	2
SEPT	1220	1462	1801	76	60	40	66	43	67	500	348	288	11	12	10
OCT	1356	1488	3110	110	90	86	55	94	82	668	556	474	6	3	6
NOV	1850	2164	3588	134	158	131	57	85	67	543	582	828	0	1	1
DEC	2000	2500	2348	40	50	27	150	N/A	32	225	N/A	171	0	0	8
TOTAL	**17890**	**22909**	**33493**	**899**	**842**	**845**	**1065**	**1019**	**1002**	**3601**	**2964**	**3245**	**29**	**27**	**30**
Avg/Mo	1491	1909	2791	75	70	70.42	89	85	83	300	247	270	2	2	2.5

NOTE: These numbers are preliminary and may be revised based on future analysis.
DO NOT CITE

events. Average monthly California sea lion numbers during 2003 (Table 4) were consistently higher than they have been since 1998, reflecting the moderate El Niño conditions. Peak monthly counts exceeded or approached 5000 animals during 4months (February, March, June, and October)and 5803 sea lions were counted during National Marine Fisheries Services (NMFS) aerial surveys in July. This was the highest number of California sea lions on the Refuge in 5 years, but numbers were well below (66% lower) the record numbers recorded during the 1998 El Niño.

Most California sea lion young in California are produced south of Point Conception, with the Farallons representing the northern breeding limit for the species. Prior to 1998, only a few pups are born on the Refuge each year, but more pupping has occurred since the 1998 El Niño. NMFS' aerial count of 48 pups on July 14 was the highest number of pups ever recorded.

The garish and unwelcome appearance of the serial killer, Zalophusaurus Rex (pictured here with a murre in its jaws), in the Upper Shubrick murre colony was noted above in G.5. Other emaciated California sea lions were noted in unusual places throughout the summer, including one feeding on gull carcasses along the cart path, and several high on the Marine Terrace. It is hoped that this reflects poor food availability combined with high seal numbers, rather than a sinister behavioral change. The situation merits future monitoring since the Marine Mammal Center (MMC) occasionally releases rehabilitated California sea lions that near the Farallons. In May, 7 MMC-rehabilitated seals were released near the Refuge, and one of the starving Marine Terrace seals had a MMC flipper tag.

In contrast to the California sea lion, the Farallons are near the southern breeding limit of the **Steller sea lion**, which pups only as far south as Año Nuevo. Steller sea lions breed in small numbers in spring and summer (May through August) on the South Farallon Islands, and haul-out in larger numbers throughout the year. Births occur from late May through mid-July and copulation occurs 1-1/2 to 2 weeks after postpartum. Females typically return to the same pupping site in successive years. It is possible that pupping and breeding occurs on North Farallon Island, as Steller sea lions have been observed there, but data is lacking.

The average number of Steller sea lions on SFI during 2003 was 70 (Table 4). The peak number of Steller sea lions counted during the breeding season was 113 in June. The high count of pups counted from mainland vantage points in September was 2, however the National Marine Fisheries Service counted 13 pups on a July 14th aerial survey. Their remote rookery location on West End makes it difficult to monitor reproductive success from land.

Another influx of Steller sea lions occurs on SFI in the fall (September to December) when mother-pup pairs from Año Nuevo haul-out on SFI.. Fall numbers peaked at 149 in November. An unusually high number of 373 Steller's were counted during the March 13th pinniped census. Large aggregations were on Shell Beach, Indian Head Beach, and Mussel Flat.

Pacific harbor seal populations on SFI grew at an annual rate of 10.4% between 1973 and 1994. This increasing trend is probably explained by poor food availability which has forced seals to leave their coastal foraging grounds and search for food in more pelagic waters. Marked peaks in abundance occur during ENSO such as 1998 when an all-time high of 190 harbor seals were counted (Table 3A). The 180 peak seal count in January (Table 3A) was the highest recorded since the 1998 El Niño, however average monthly numbers were typical of recent years (Table 4). The Harbor seals occasionally pup on SFI, and two pups was noted this year.

It is estimated that over 80,000 **northern fur seals** used the Farallons during the breeding season prior to the arrival of American and Russian sealers in the 1800s. This species was extirpated from the Farallons due to intensive hunting in the early 1800s, and until 1996 northern fur seal use consisted of immatures occasionally being seen around, or hauled out on, the island. In 1996 the first fur seal pup was recorded on West End. Until this historic Farallon birth, northern fur seals were only known to breed in Alaska and the Channel Islands in North America.

Eight northern fur seal pups were observed on West End this year (Table 3B). The breeding site was located in the same area previous years: In Upper Mirounga Valley near Pastel Cave Highlands. There now appear to be two separate harems. Since pupping sites are not visible from land or sea vantage points, pups can only be monitored by accessing West End on foot in the early fall after seabirds have left their breeding sites.

Elephant seals were also extirpated from the Farallons, but returned in 1959 and began breeding on SFI again in 1972. Elephant seal births between 1973 and 1983 followed a pattern of exponential growth, increasing at a rate of 56.5% per year. The SFI population apparently reached carrying capacity in 1983, and between 1983 and 2000 the number of pups produced declined an average 3.5% annually. In 1983, a peak of 475 pups were born, compared with an estimated 149 births during the 2003 season. The number of adult bulls and cows has been declining on the Refuge as well.

It is thought that the major reason for this decline is deterioration and erosion of beaches that are important pupping areas. In the 1980s, major elephant seal breeding activity shifted from the Sand Flat on SEFI to Shell Beach on West End after severe winter storms in 1983 eroded the Sand Flat Beach and access routes. Winter 1997-98 El Niño storms severely eroded sand on the Shell Beach access route, leaving a series of steep rocky cascades. After 1998, numbers of cows using Shell Beach declined dramatically, and the numbers of cows pupping on SEFI increased compared to the 90's. More elephant seal breeding activity currently takes place on SEFI than on West End.

Reproductive success of elephant seals was monitored daily at four Southeast Farallon Island sub-colonies and during 2-3 visits/month to the two West End sub-colonies. The first pregnant elephant seal cow of the 2002-03 season arrived on December 19th , 2002, and pupped 1 week later on December 26, 2002.

In summary, breeding dynamics of elephant seals on SFI have changed, primarily due to beach erosion. Wave action and heavy use by pinnipeds have caused sand to wash away. Competition for space with California sea lions may also be a contributing factor in this decline. It is possible that the increase in elephant seal numbers reported from Pt. Reyes Headlands might reflect the displacement of Farallon island elephant seals.

PRBO has been collecting information on **cetacean** numbers, as observed from SEFI, since 1973. Observations of most species have increased, probably due to population increases of some species (e.g., gray, blue, and humpback whale), increased effort, and observer bias (PRBO personnel have possibly become better at sighting whales). Gray whales are commonly observed migrating during winter months, southbound in early winter and northbound in late winter. Throughout January,135 gray whales were counted heading south, and (perhaps) coincidentally, 135 were observed heading north during February. One to three gray whales were seen almost daily feeding around the island, from May through November.

Other species observed during 2003 were blue, humpback, fin, Minke, Sei, and orca whales; Pacific white-sided, Risso's and northern right whale dolphins; and Dall's porpoise.

11. Fisheries Resources

In September and October commercial squid fishermen were observed fishing near the Refuge with large purse-seine nets, sometimes within 300 meters from shore. This type of fishery uses bright deck lights to attract squid to the surface, fishing usually occurring at night or near dusk. Refuge and PRBO staff became concerned that illumination of the colonies would disrupt breeding seabirds, and lighted boats would disorient nocturnal seabirds and attract predatory gulls, causing injury and mortality to ashy storm-petrels and Cassin's auklets. Refuge personnel sent letters to California Department of Fish and Game (CDFG), and presented testimony at a Fish and Game Commission hearing in December, requesting an emergency closure of squid fishing around the Farallon Islands. Squid concentrations and squid fishing normally occurs further south, but this fall a few Half Moon Bay boats followed the squid movements north, and caught an estimated 1,323 tons of squid in 2003 (CDFG unpubl data). This compares with an average annual harvest of 0.03 tons from Farallon waters. Squid landings from the Farallons were only reported two other times in the last 20 years: 52 tons in 1986 and 0.08 tons in 1992. While commercial squid fishing may be rare, it could have negative impacts on Farallon breeding seabirds.

During 2003, PRBO investigators recorded 66 white shark feeding events. Twenty attacks (30%) were on juvenile northern elephant seals, and 10 attacks (15%) were on California sea lions. For the remaining 35 attacks, the prey species were not identified. It is surmised that most of the "unknown" category were California sea lions because, unlike elephant seals, their carcasses do not float for long and produce a small indistinct blood slick, so are they are not as easily identified. This makes 2003 unusual, in that sharks fed primarily on seal lions rather than elephant seals, their customary prey.

Six white sharks were tagged with satellite tags during fall 2003. Tags are programed to pop-off in six to twelve months. A total of 23 white sharks have been tagged during the 5 years of this study. Information from previously tagged sharks document they travel south and west into the Pacific, as far as Hawaii.

15. Animal Control

The Refuge and PRBO continued planning and data collection for a project to eradicate non-native house mice from SEFI because of their adverse affects on the natural ecology (Section D-5 and G.6). Monthly/ bi-monthly snap trapping to document the house mouse population cycle (*Mus musculus*) continued in 2003.

Andrew Hagen completed a stomach content analysis of 57 mice captured on SEFI from February 2002 to March 2003 for a Humboldt State University senior thesis project. He found that Farallon mice are omnivorous, eating plants (both native and invasive species) and invertebrates. House mice consume some species (e.g. *Coleoptera* beetle larvae) consistently through the year, and others seasonally (e.g. *Lasthenia* during the spring and *Hordeum* during the fall). Native plant species: *Lasthenia maritima, Spergularia* spp. and *Claytonia perfoliata* constitute 60% of the plant species found in mouse stomachs, yet 69% of plant species on SEFI are invasive (Hagen 2003). Thus, house mice may be a factor in efforts to control invasive plants and re-establish native *Lasthenia*; they consume the flower heads of this native endemic.

Greg Howald, Brad Keitt and Holly Jones of Island Conservation and Ecology Group visited SEFI with Refuge Manager, Joelle Buffa in April and prepared a mouse eradication plan for the Refuge (Howald et al 2003). A proposal for funding this work, estimated to cost $729,400 over a 4-year period, was submitted to the Command Oil Spill Trustee Council in May 2003.

16. Marking and Banding

In 2003, PRBO banded 3,848 seabirds and landbirds of 101different. Since 1971, western gulls in study plots have been banded with U.S. Banding Lab metal and colored bands. Common murre chicks in the Upper Upper colony are banded in July. Brandt's cormorant chicks were banded at three sites: Shubrick, Sea Lion Cove, and Corm Blind. Pigeon guillemot, Cassin's auklet, and rhinoceros auklet chicks are banded in monitored nest box/natural burrow sites with metal and/or color bands. Rhinoceros auklet adults are banded when captured in mist nets during diet studies. Since 1992 a mark/recapture study has involved mist-netting and banding ashy storm-petrels and Leach's storm petrels with metal bands. Some individual birds have been followed as nestlings through 20 years or more of life by reading numbers on metal bands.

Elephant seals are tagged with two numbered pink plastic tags on the hind flippers. These animals can then be identified on the Refuge and at other sites in California, and provide information about longevity and movements. Farallon-born elephant seals have been observed at haulouts on San Nicholas Island, San Miguel Island, Año Nuevo and Castle Rock NWR in California, and on Isla San Martin, Baja Mexico.

17. Disease Prevention and Control

Botulism-killed western gulls are seen periodically throughout the year. It is assumed that they contract the disease while feeding in mainland dumps.

Pinnipeds with materials such as packing straps, monofilament, and salmon lures constricting their necks or other body parts are often observed hauled-out on the Refuge. Typically, 45-60 "ringed" pinnipeds are observed per year. The vast majority (around 90%) are California sea lions, but northern elephant seals, Steller's sea lions, and harbor seals are sometimes encountered (Hanni and Pyle. 2000).

H. PUBLIC USE

1. General

The Farallon National Wildlife Refuge is closed to the public. However, sightseeing boats cruise the waters around SEFI to observe mammals and seabirds. Boats were recorded during most months, although peak numbers visited in late summer and the fall. A total of 94 sightseeing boats with an estimated 3326 people on board were recorded during the 2003. A shark cage diving boat, *The Patriot*, visited on 39 days with an estimated 345 people on board during the months of September, October and November. This venture, which submerses divers in a cage to view white sharks in waters off-shore of the Refuge, began in 2002.

Media visits offer additional opportunities to educate the public about Refuge wildlife. In September, NBC Channel 11 reporter Jean Elle and a photographer visited the island for one day to film a television news segment on the come-back of the northern fur seals. On Mother's Day a BBC documentary called *Super Mums* was televised. It contained footage and mug shots of Farallon western gulls, filmed by the crew which visited under a Refuge SUP in 2002. In August, Times Warner, Inc. journalist Susan Casey spent a week on the island collecting information for a series of articles in Times Warner, Inc. publications. An article in the *Fortune Magazine* issue, profiling the Refuge Manager's unique job, resulted from this visit.

Craig Hanson & Farallon Rock at Lawrence Hall of Science Exhibit

A Farallon rock is featured in the UC Berkeley Lawrence Hall of Sciences' new exhibit on geological forces of the Bay Area. This Pacific Plate rock is matched with a mainland rock to show how plate tectonics moves the Farallon Islands 2 cm. per year north each year. To demonstrate this, the two rocks will be moved apart (see rocks on movable pedestal, pictured right) the appropriate distance each year. The rock, which spent millions of years slowly riding northwest from southern California, took a sharp and abrupt right turn on a Farallon patrol boat during 2003 to end up in the museum.

7. Other Interpretive Programs

During 2003 the Refuge Manager made four presentations on "Seasons and Seabirds of the Farallon Islands to the following groups: Marin and Mt. Diablo Golden Gate Audubon Societies, the Santa Cruz Bird Club, and the Oakland Museum.

17. Law Enforcement

USFWS regulations prohibit wildlife disturbance. Low level flights (below 1000') frequently flush wildlife so aircraft flying under 1,000' over the island are treated as potential violations. Three private aircraft and one un-marked military helicopter flew below 1,000 feet over the Refuge and flushed wildlife during 2003. Island personnel document such events if they can get a tail number and submit a violation report to Refuge

law enforcement personnel. The Blue Angels practiced maneuvers over the island, flushing birds and mammals, several times during the Bay Area's "Fleet Week" event in October, until the Sanctuary Manager contacted their command.

Jet skis have been banned in the GFNMS since October 2001. The waters within one nautical mile of the Southeast and North Farallon Islands have been established as California State Ecological Reserve, and boating restrictions prohibit boats within 300 feet of most of the shoreline between March 15 and August 15 (Section 630 (b) (71), Title 14, California Code of Regulations). At least ten boats were documented violating the seasonal boat closure area in 2003. California Dept. of Fish and Game, who enforces the closure, were contacted when sufficient identifying information could be gathered on the boat(s).

I. EQUIPMENT AND FACILITIES

1. New Construction

The Farallon ROS and other refuge staff improved and enlarged an existing cement pad located south of Heligoland Hill to facilitate the installation of a 3000 gallon temporary diesel storage bladder. The improvement consisted of smoothing and filling the exiting cement with vinyl patch and the enlargement consisted of building a 2"x6" frame covered with 3/4" plywood. The expansion was needed to provide a level base for the bladder and secondary containment that measures 20' x 20'. A metal frame was constructed to provide a means of covering the bladder with a tarp and protect it from UV rays.

2. Rehabilitation

Water System: During the "2002/2003" rain year (November 2002 - April 2003) 55,687 gallons of water were "harvested" during the collection system's fifth year of operation. This compares with 49,625 gallons in 2002, 51,500 gallons in 2001, 29,830 in 2000, and 38,000 gallons in 1999. Water samples are taken 4 times during the year and tested by Alameda County for coliform and nitrates. Coliform continues to test negative.

The water system had several problems and received upgrades during 2003. The 3" galvanized supply line from the gravity tank to the house was replaced by a 3" schedule 80 PVC pipe. Leaks in the PVC joints have been problematic since the pipe was installed. The demand pump in the pumphouse was found to be inoperable during the pipe replacement leaving the island showerless for nearly a week. A new demand pump was installed in November and has been trouble free. The new pump was fitted with a 1-way valve at the intake to eliminate the need for priming.

East Landing Derrick: Chronic problems continue with the boom tip sheave, which insists upon sticking despite our best efforts. Despite the switch to a stainless steel sheave, problems continue at the boom tip. Less then a month after AC-3's annual fall maintenance trip and certification, the sheave began sticking again. It appeared the sheave was slightly leaning to one side and rubbing. After much discussion with AC-3 we were could not agree on how to remedy the problem. We then found another contractor to work on the derrick. AC-3 installed the old galvanized sheave instead of the stainless sheave and the rust built up on the cheeks of the boom tip were not adequately scraped and repainted by AC-3. The problem was identified and corrected in January

of 2004 by Nautical Engineering. The annual maintenance schedule has been adjusted to avoid the rust problems that cause the sheave to stick. In March, the bull wheel slewing sheave popped off the shaft. Island crew were able to repair the problem - a stripped shaft that held the bolt - by re-threading the shaft, and AC-3 checked all sheave shafts during their annual maintenance visit. A maintenance deficiency was identified in the maintenance of the Eurodrive motors. The oil in the gearboxes had not been part of the maintenance schedule. This problem was a result of a "hitch" that developed in the lift line that required the use of the winch handle to nudge the gears to get them started. Changing the oil solved the problem. Continued maintenance issues prompted us to search for another derrick mechanic.

Residences: Island biologists continue to praise the main residence as a comfortable shelter from the harsh marine-scape. Some problems were encountered during 2003 that involve both the conventional and unconventional portions of the house. One of the seals in a window replaced during the remodel has failed, leading to the permanent fogging of the window and reduced insulation. Mouse holes are becoming more common in the drywall. Some of the down-spouts on the Coast Guard house have fallen off. The hand rails on the exterior of the houses were replaced with redwood to reduce splinters and a variety of measures were taken to stiffen the wobbly stairs.

The refrigerators were the Achilles heel of household life in 2003, temporarily displacing the Webasto. The thermostat in one unit went out and then the refrigerant needed to be recharged in two units. Though expensive and fairly new, the refrigerators have not met our expectations for reliability. Door latches and seals have been problematic as well. It was finally determined that they came from the factory using a sealant that is corrosive to the copper tubing causing the refrigerant to leak. The leaks will accelerate over time as the corrosion advances. We are currently negotiating a solution with Sunfrost. An electrical issue has developed in the upstairs bathroom due to the lack of outlets in the bathroom. The Farallon-rigged outlet located in ceramic light fixture on the ceiling has is not up to safety standards for moist locations such as a bathroom.

Sanitary Waste Treatment System: We are seeking the best replacement for the composting toilet, and a solution that will meet the State Water Quality Control Board's discharge requirements and work within the Farallon limitations. Currently a "packaged" mini treatment plant is the leading candidate. This system is a large compartmented box that uses anaerobic and aerobic bacteria, plus either chlorine or UV to treat wastewater.

4. Equipment Utilization and Replacement

Generators/Fuel: Lister 2 generated most of the power in 2003 because Lister 1 was erratic and would not run the derrick. Several unsuccessful attempts were made to stabilize the voltage with use of a voltage regulator and a rheostat. After that route led to a dead end, Air Cooled Engines determined the diodes were defective and so corroded that electricity was dispersing across the corrosion. Lister 1 is currently partially disassembled, awaiting for a new set of diodes.

Outboard Motors/Boats: The 15' Boston Whaler was decommissioned and replaced by a new 15' Safeboat. The new boat meets OSHA requirements for a personnel lifting device and is equipped with a new 50hp Honda outboard. It has exceeded expectations as a work platform.

6. Energy Conservation

March marked the 5-year anniversary of operating the field station on solar power. Performance continues to exceed expectations. Solar power supplied over 90% of the Refuge's power needs, and saved at least 5,000 gallons of diesel fuel during 2003. Fuel consumption since the photo-voltaic system was installed in 1998 is shown below. Applied Power made minor adjustments to the P-V system during their annual service visit in February.

1999	2000	2001	2002	2003
600 gal	980 gal	546 gal	619 gal	475 gal

J. OTHER ITEMS

1. Cooperative Programs

Since solarizing their lighthouse in the early '90s, the US Coast Guard has been reducing its activities on Southeast Farallon Island. They stopped delivering fuel and water in 1997. The USCG still provides helicopter support for Refuge and other government employees during the non-seabird nesting season (August 15-March 15), when landings are allowed. In October, CG contractors completed Phase II of hazardous materials clean-up (See Section E.6).

The Farallon Patrol is a volunteer group of about 20-30 sailboat and motorboat owners who take turns making twice monthly runs out to the Refuge. Since 1969 they have donated their time, boats, and fuel to transport personnel and supplies.

2. Items of Interest

2003 marked the 400th anniversary of the islands' naming by Spanish explorer Sebastian Vizcaino, who named them, "Los Farallones de Los Frayles," - the Promontories of the Friars. A proclamation, signed by Mayor Willie Brown of San Francisco, proclaimed January 6, 2003 as "Farallon Island Day". Dignitaries from the California State Legislature, the media, and government agencies including the Environmental Protection Agency and California Coastal Commission recreated a portion of the explorers' trip on August 15 in a boat that left San Francisco and circumnavigated the South Farallon Islands. The event was organized by the Gulf of the Farallones National Marine Sanctuary and the California Heritage Council. Since the group could not tour the island, Refuge Manager Joelle Buffa boarded the boat and regaled the seafarers with tales of island wildlife and daily life on the island.

Neil (organizer), Joelle Buffa (FWS), Ed Ueber (GFNMS)

PRBO intern Katie Kauffman was bit on the upper thigh by an elephant seal while tagging weaned pups in February. The bruise around the puncture wound turned a spectacular shade of blue, purple, and yellow but did not become infected due to antibiotics and first aid rendered by the crew. It seems like unusual events were Katie's specialty. She spotted a dead human body floating in Maintop Bay February 8th. The Refuge, US Coast Guard, and San Francisco Police Dept were contacted, and island personnel took shifts at the lighthouse keeping the body in sight. However, by the time a recovery team arrived, it was near dark, the body floated away, and was not found.

In March, Air Flight Services of Santa Clara conducted an aerial flight over South and North Farallon Islands for the purposes of creating a color infra-red (IR) orthophoto and digital contour map of the Refuge. Figure 2 shows the color IR image of South Farallon Island, taken at low tide.

An unusual migratory wave of Hoary Bats were observed during August (31 total) and September (61 total). Most of the bats were females, although a few females and one copulating pair was observed. The mating behavior of Hoary Bats is poorly understood, and this may be only the 2nd documented copulation ever recorded (the other was on the Farallon Islands as well) according to USGS bat expert Paul Cryan. Paul visited the Farallons in September 2002 to study Farallon bats, which unfortunately failed to appear.

3. Credits

This narrative was written by Joelle Buffa and Jesse Irwin.

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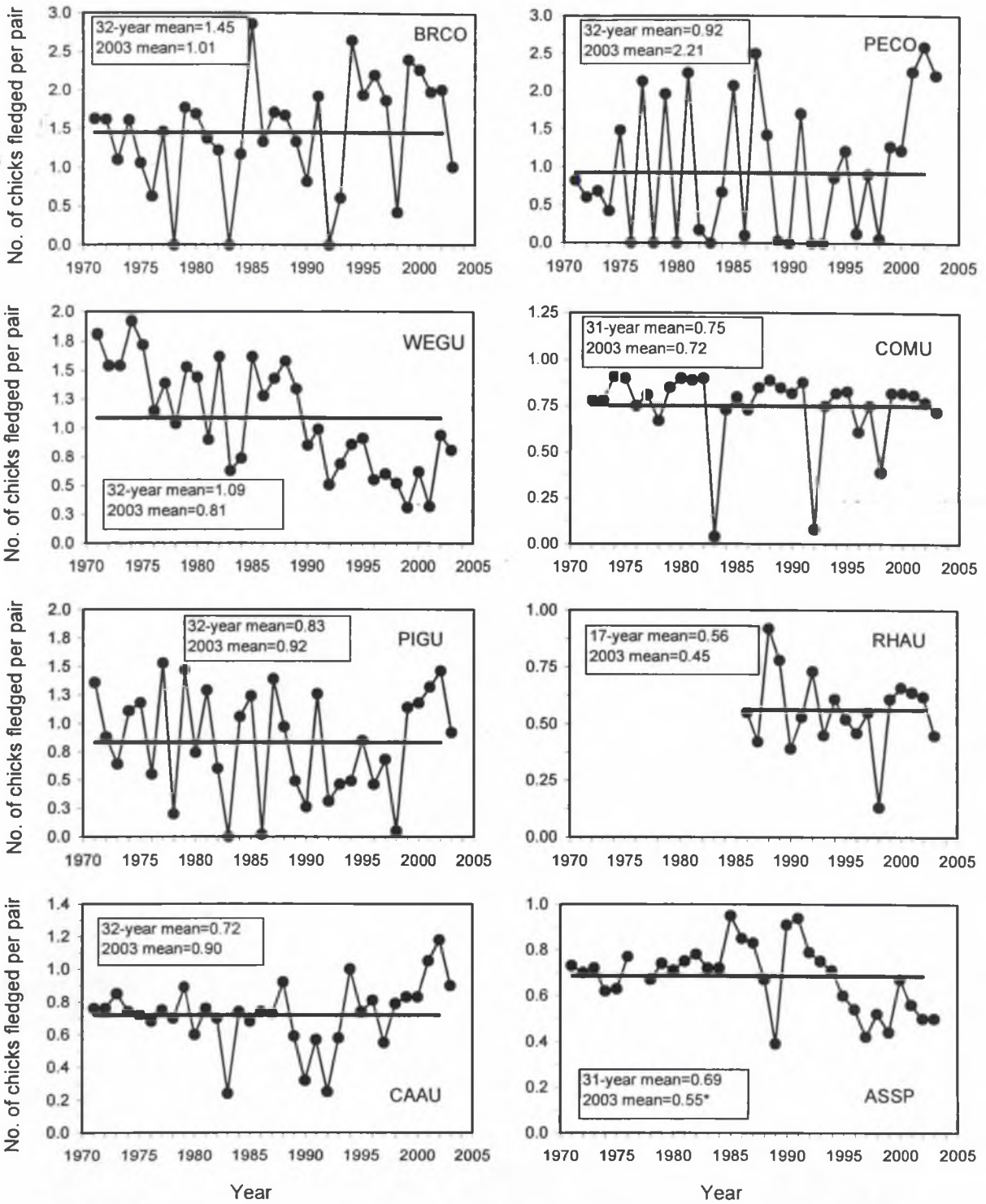

* Estimate only includes those chicks that fledged by mid November.

Fig. 1 Productivity of 8 species of seabirds on Southeast Farallon Island, 1971-2003. Productivity is measured as number of chicks fledged per breeding pair (includes first attempts, relays and second broods). The bold horizontal line indicates mean productivity from all attempts between 1971 and 2002. Please note the different scales on the y-axis.

FIGURE 2 South Farallon Island Color Infrared Photo

FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2002

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2002

Refuge Manager — December 15, 2003 — Date

Refuge Complex Manager — December 20, 2003 — Date

INTRODUCTION

Farallon National Wildlife Refuge was established in 1909 and is located approximately 28 miles west of San Francisco. It is comprised of four groups of islands including the North Farallons, Middle Farallons, and Noonday Rock which are all designated as wilderness areas. The South Farallon Islands were given refuge status in 1969 and are the largest group consisting of 120 acres and reaching a height of 370 feet. West End, a portion of the South Farallon Islands, is also designated a wilderness area. The Refuge totals 211 acres.

The Refuge comprises the largest continental seabird breeding colony south of Alaska. It supports 13 nesting species including the world's largest breeding colonies of ashy storm-petrel, Brandt's cormorant, and western gull. Six pinniped species also breed or haul out on the Refuge. After absences of over 100 years, northern elephant seals and northern fur seals returned to breed on South Farallon Islands in 1972 and 1996, respectively.

The Farallon Islands are a granitic formation that is part of the Farallon Ridge. Shallow soils can be found scattered on some of the South Farallon Islands. Vegetation is dominated by Farallon weed, an important nest building material for cormorants and gulls. Floral diversity is limited and is made up of a high proportion and number of nonnative species due to the large amount of human activity on the Southeast Farallon Island (part of the South Farallon Islands) since the 1800's.

Wildlife populations were heavily exploited in the late 18th and early 19th centuries for meat, hides and eggs. Over-fishing of sardines reduced seabird food supplies. Some species were extirpated or declined drastically. Historical estimates indicate that thousands of northern fur seals and as many as 400,000 common murres once populated the islands. An active Coast Guard station further impacted island wildlife and habitat until the full automation of the light station in 1972. Under Refuge stewardship, extirpated species have re-colonized the islands, and wildlife populations as a whole are slowly recovering. Still, wildlife remain vulnerable to the impacts of pollution, oil spills, gill net fisheries and global climate charges. The Service has cooperative agreements with Point Reyes Bird Observatory and the U.S. Coast Guard to facilitate protection and management of the Refuge

TABLE OF CONTENTS

F. HABITAT MANAGEMENT

G. WILDLIFE

H. PUBLIC USE

I. EQUIPMENT AND FACILITIES

J. OTHER ITEMS

A. HIGHLIGHTS

- Farallon seabirds experienced their fourth exceptional breeding season in a row. Productivity and breeding population sizes were higher than average for most species, and the common murre breeding population on the Refuge is estimated at approximately 170,000 (Section G.5).

- Lieutenant Governor Cruz Bustamonte, and high level officials of BLM, FWS, and several environmental organizations visited the Farallons during two special VIP trips (Section J.2)

- Progress was made on eliminating several safety and environmental hazards: Hazardous materials in and around the Powerhouse were removed, the North Landing Boom was demolished, and a sprinkler system for the residence was designed (Section E.6).

- The Farallon Operations Manual was completed (Section E.6).

B. CLIMATE CONDITIONS

Temperatures are relatively constant throughout the year, seldom falling below 45 °F or rising above 65 °F. Most rainfall occurs in the winter. Summer moisture is usually limited to damp fog. Offshore fog banks frequently envelope the islands in dense fog.

Mean monthly sea surface temperatures (SSTs) in waters surrounding the Farallon Islands from March to August were approximately 1 °F cooler than the 31-year average of 53.5 °F. A huge storm on November 9 that brought 30 foot swells was a precursor to a very wet December, when 9 inches of rain fell.

Feeding flocks of seabirds were noted throughout the breeding season and into early fall. Whales joined the flocks of birds feeding on krill during September.

D. PLANNING

5. Research and Investigation

Farallon NWR is managed by the Fish and Wildlife Service out of the Refuge complex Headquarters. We hold a cooperative agreement with the Point Reyes Bird Observatory (PRBO) for their biologists to be present on the island year-round. They monitor seabirds to determine breeding population size and productivity for 11 species of nesting seabirds, and census number of adult and pups of the 5 species of marine mammals that haul out on the Refuge. PRBO also provides day-to-day resource protection, preventative maintenance, and conducts research approved by the Refuge. The Service provides funding, direction, maintenance support and some assistance for studies.

PRBO studies were numerous, some of which are long term projects that have been on

going since the 1970's. They included:

Population demography of the western gull: This study examines survival, breeding biology, and breeding site fidelity in relation to life history traits, reproductive life span, and performance. Monitoring known-age gulls provides the core of this project. The oldest known-age western gull in this study lived at least 30 years; he hatched in 1971 and continued returning to the island to breed until 2000.

Demography, population dynamics, and food habits of common murre: Four study plots (Shubrick, Upper Upper, Cliff, and Tower) are monitored daily during the breeding season to determine number/location of breeding sites, phenology, breeding success, incubation, and chick-rearing periods. Intensive observations are made of parental care, chick diet, feeding intervals, and foraging trip duration. Diurnal attendance is determined by conducting 3 all-day censuses. Studies of the fish adults feed to chicks have shown that northern anchovy, sardines, and juvenile rockfish are the most important provisioning items. The consumption of juvenile rockfish dominated in the 1970s and 80s, while anchovy and Pacific sardine dominated in the 1990s. In 2001 and 2002, juvenile rockfish were again predominant in the chick diet.

Demography, population dynamics, and food habits of Brandt's cormorants: The colony at the Farallons represents the largest single known Brandt's cormorant colony anywhere. Breeding/ productivity studies are conducted at Upper Shubrick and Corm Blind Hill. Reproductive success of known-age birds is being investigated to determine parameters such as age at maturity, fecundity, longevity, mate/site fidelity, survival to breeding age, and how these relate to breeding effort and success. A diet study, initiated in 1983, has shown that midshipman are the most important group in terms of mass, comprising over 50% of the identified diet, although rockfish are the most abundant species-group recorded.

Demography, population dynamics, foraging ecology and diet of pigeon guillemots: Survivorship and parental care is studied by observing color banded birds. Diet watches are conducted at known sites. Observers record site number, band markings, time, and the prey species being taken to breeding sites. Guillemot diet has tracked a pattern similar to murres: During the 1970s and '80s, juvenile rockfish were the primary prey item fed to chicks, while in the 1990s sculpin and flatfish (both bottom fish) predominated. In 2001 and 200s, pigeon guillemots fed primarily on juvenile rockfish and sculpin, and to a lesser extent on flatfish, and gunnel.

Demography, population and diet of rhinoceros auklets: A mark/recapture study was begun in 1987. As of 2002, 720 birds had been banded and previously marked birds had been recaptured 848 times. The objectives of this study are to more accurately determine population size, although data has not yet been analyzed. Birds are mist-netted at the entrance to breeding burrows at four sites, and food items carried in by netted birds are collected and identified. Diet samples collected this year found them feeding primarily on juvenile rockfish and Pacific saury; lingcod, squid, anchovy, sablefish, and herring/sardine were other identified food items. Occupancy rates of 30 natural burrows/crevices are investigated by using a burrow camera.

Demography, population dynamics, and food habits of Cassin's auklets: Age specific

reproductive performance and survival, lifetime reproductive success, and recruitment patterns of Cassin's auklets are studied by banding birds and monitoring known-age individuals nesting in artificial nest boxes. Regurgitations are collected to determine food items brought back to chicks. Analysis of diet items since 1994 show krill *(Thysanoessa spinifera* and *Euphausia pacifica)* to be the main food items.

Colony Formation in Cassin's auklet: This study was initiated in 1990. It was designed to investigate the impacts of western gull predation on Cassin's auklets. Specifically, it addresses the question of whether gulls prevent auklets from colonizing areas which have previously supported high densities of nest burrows. Ten 100 square meter plots are monitored during peak incubation. Occupancy rates of (a sub-sample of) natural burrows in index plots are determined by using a burrow camera.

Population status and productivity of ashy storm-petrel: A mark-recapture study using mist netting was initiated in 1992 and continued for the 11th year. Petrels are mist netted and banded at two locations two nights, weather permitting, April through August. To date 3522 ashy storm-petrels (ASSP) have been newly banded (393 of these in 2002) and previously marked birds have been recaptured 684 times (42 recaptured in 2002). The goal is to determine population size and assess population trends by comparing results with data sets from1972 and 1992, however data have not yet been analyzed. Leach's storm-petrels are also banded in this study. Productivity of ashy storm-petrels is monitored at known natural crevice nesting sites.

Ashy storm-petrel predation monitoring: Several studies were initiated or continued in 2002 to better document and quantify predation by western gulls, burrowing, and house mice: 1) Collection of ASSP wings along the Lighthouse Path (LHH) was standardized; 2) Owl pellets were collected from known roosting sites and analyzed (Section G.6). 3) A Sentinel low light camera/time-lapse VCR was set up on LHH in an attempt to record gull predation on petrels. However problems with the system prevented successful execution of this experiment; 4) Quail eggs and track plates were placed in ASSP nesting boxes to document mouse predation; 15 each in North Landing, Russian House, and Domes (sites that were formerly used in the social attraction experiment) - Section G.5.

Tufted Puffin: Daily observations at historic nesting sites were conducted during two 1-week periods (May and July) to estimate number of pairs. Attempts to band chicks in 2002 were unsuccessful.

Black Oystercatcher: Historic nesting sites are monitored.

Reproductive ecology and survival of the northern elephant seal: Multiple objectives focus on the effects of age on reproductive success and the effects of white shark predation on juvenile elephant seal survival. Methods included tagging, marking, and censusing elephant seals during the winter breeding season (Section G.9). Studies have been conducted annually since the Farallons were re-colonized by breeding seals in 1972.

Biology of the White Shark at Southeast Farallon Island (SEFI): This study is being conducted in the waters around the Farallon NWR using the Refuge as an observation point. During fall months (September 1 to November 30) observers conduct all day watches from Lighthouse Hill in order to detect and describe shark attacks on pinnipeds. Events are videotaped and photographed whenever possible and a boat is often launched to take researchers to the site of the attack. Individuals sharks are identified by distinctive markings. The occurrence and behavior of white sharks, and the behavioral tactics white sharks use to hunt and capture their have been published. Objectives are to determine population size, recruitment, return probability and trends; the relationship of shark predation to environmental factors; and trends in white shark predation. In 1999 a satellite tagging component was added to track shark movement. Two white sharks were tagged in 1999, 6 were tagged in 2000, 10 were tagged in 2001, and 2 were tagged in 2002.

The Fish and Wildlife Service conducted the following studies:

Aerial census of murre colonies - The annual breeding season aerial photographic survey of Farallon colonies took place on May 28, 2002. Colonies are photographed using a 35mm camera, with 300mm lens, shooting out of the bottom of a twin-engine Partanavia airplane. Photographs are taken at an altitude of 800' - 1,000' above the colony.

House Mouse population dynamics: A study, initiated in March 2001, to document the population cycle of house mice (*Mus musculus*) on SEFI continued during 2002. Four transects, each consisting of seven trapping sites, are established in various habitat types around the accessible portions of SEFI.. The 28 baited dCon snap traps were set for three consecutive nights twice/month Jan-March, once/month April-August, and twice/month September - December, 2002 (See Section G-15).

Adam Brown setting mouse traps

Boardwalk burrow study: A 5-year study, initiated in 2001, of Cassin's auklets colonizing newly created/protected habitat around SEFI buildings continued. Objectives are to quantify the number of auklets nesting under 812 feet of boardwalks, which were constructed in September 2000, and compare burrow density to natural sites. Boardwalks were censussed for burrows in February and March 2002, and a sample of burrows were sampled for occupancy in July 2002. Peak burrow count in March was 65, and 7 (22%) of 31 burrows checked were occupied in July 2002.

The Refuge occasionally issues permits to other researchers to conduct studies. During 2002 these included:

Intertidal communities within GFNMS Monitoring:
In 1992 GFNMS biologists began monitoring the density and diversity of intertidal species

(invertebrates and algae) at six locations on Southeast Farallon Island. Point and photo quadrants are visited three times annually (February, August, November). The purpose is to develop baseline species inventory to determine resource risk and damage assessment in the event of an oil spill or other human-induced of natural disaster. As of December 2002, over 200 species of invertebrates and 200 marine algae have been documented, including one that had only been previously reported from Japan .

Hoary Bat migration study: Paul Cryan, a bat expert with the US Geological Survey in Albuquerque, NM visited SEFI from August 31 to September 8 under a Refuge Special Use Permit. Objectives of his study were to document the occurrence, sex ratios, age, and other biological aspects of hoary bats (*Lasiurus cinereus*) on SEFI. Although hoary bats typically appear in variable numbers between mid-August and late-October, all managed to avoid the island during Cryan's visit. A search protocol was written and island personnel trained so the census can continue in future years. Learning more about SEFI's hoary bats would help shed light on the poorly understood movements of this species, which winters in California and breeds in the eastern US. Cryan hypothesizes that hoary bats landing on the Farallon Islands are probably wayward migrants, blown off course during southward fall migration.

E. ADMINISTRATION

1. Personnel

Russ Bradley & Pete Warzybok at No. Landing

Russ Bradley replaced Kyra Mills, so the PRBO Farallon Seabird Biologist team now consists of Russ and Pete Warzybok. Fall biologists are Adam Brown (lead) and Peter Pyle (relief). On February 12, 1977, Jerry Nusbaum, PRBO's reining winter (elephant seal) biologist celebrated the 25th anniversary of his first visit to the island . In his 25 years caretaking the island, Jerry has spent approximately 2250 days (equals 54,00 hours or 3,240,000 minutes) on SEFI, and has tagged an estimated 5,000 elephant seals (he loves to count things). He has contributed his carpentry skills to many projects, including bird blinds, kitchen cabinets, and auklet nesting boxes; and kept the solar equipment and house floors spotless, To recognize this achievement, Jerry was awarded the Refuge's prestigious "Farallon Outstanding Service Award" at the annual Farallon Patrol dinner in March. Unfortunately, Jerry could not accept the award plaque in person because the boat scheduled to bring him back to the mainland was canceled due to weather.

The Farallon ROS position, now in its 4th year, was funded by a combination of storm relief (1998) dollars, Apex, MMS, and Cape Mohican Restoration funds (Section E.5). After two years

as Farallon ROS, Bart McDermott got most island facilities humming smoothly, and transferred to the Complex's Maintenance Supervisor/Warm Springs Unit Manager in August 2002.

4. Volunteer Program

During the Calendar year 2002, approximately 24 volunteers donated about 10,550 hours of service to activities supervised by PRBO on Southeast Farallon Island. Volunteers assumed a variety of responsibilities including assisting with bird, mammal, and white shark monitoring; research; collecting meteorological and oceanographic data; and performing facility and equipment maintenance.

Volunteers supervised by refuge staff donated approximately 11 hours during 2002, conducting non-native plant control and maintenance activities.

5. Funding

The cooperative agreement between the Refuge and PRBO provides PRBO with an amount equivalent of one GS-7 and one GS-9, plus benefits (20%), and camp rate per diem for two persons. A total of $92,142 was paid to PRBO in 2002.

FWS Regional Office funded a total of $117,876 in special projects (see Section E.6 for additional details): 1) A Refuge Clean-up Project costing $83,476 (of which the Refuge received $15,000 for project oversight); 2) Design of Bunkhouse Improvements costing $14,900, completed under contract by Calvin Jordan Associates; and 3) Southeast Farallon Island Landing Concepts Development costing $19,500,completed under contract by URS.

Roy Clark, Environmental Officer for the US Coast Guard, secured $140,000 to fund removal of North Landing boom.

6. Safety

Progress continued to be made to correct deficiencies identified in the joint Safety Review/ Environmental Compliance Audit conducted by the Regional Office on March 2001. URS consultant David Harder completed a report evaluating landing options. Regarding East Landing, the report concluded that the derrick was originally designed to lift personnel, but recommended acquiring a new boat designed as a personnel lift, and having the derrick certified. The Farallon ROS continued to work with SafeBoat, Inc. to refine the design for the new island boat. AC3 completed the annual maintenance and inspection of the derrick in November, but did not re-certify the boom until they replaced the lifting cable in January 2003. Calvin Jordan Associates (Portland) to completed the design of "Bunkhouse Improvements" to bring the residence up to fire code standards. An MMS project was submitted to install a sprinkler and alarm system as recommended in the report. Other safety improvements included: 1) Flammable materials placed in 3 new flammable cabinets; 2) Fire extinguishers recharged; 3) MSDS binder and hazmat inventory updated; 4) Warning signs mounted as appropriate; and 5) Eye wash station flushed.

A Refuge Cleanup Project was completed by Geo Engineers in October 2002. Waste petroleum products, diesel piping and infrastructure left over from pre-solar power days, and other hazardous material stored in the powerhouse were removed from the island and disposed in approved facilities. Aerators were installed behind the Powerhouse for in situ clean-up of contaminated soil.

In September, three contractors from J.I. Garcia Construction (contracted by the US Coast Guard) demolished the North Landing Boom, which had been deemed a safety hazard. The timbers were rigged with safety lines before the metal supporting the base of the mast and one arm was cut with a torch. The boom toppled with amazing speed, accuracy, and a huge KA-BOOOM that was recorded by UC Berkeley's island seismograph. The contractors avoided smashing the nearby observation blind. The timbers were piled at the landing edge, awaiting Phase II of the USCG clean-up, scheduled for fall 2003.

Boom before demolition

Boom immediately after demolition: Sept 9, 2002 (timbers were later cut and neatly stacked)

The Farallon Refuge Operations Manual was completed, and contains protocols for handling emergencies, inspecting fire extinguishers, conducting safe landing operations, and safely operating other island facilities and equipment. The Complex Safety Officer, Barry Tarbet conducted a safety inspection in March 2002. Of the19 deficiencies identified, 17 were corrected, and an MMS project submitted to complete the others (sprinklers/alarms). The Operations Manual was also updated to cover items identified in the safety review.

F. HABITAT MANAGEMENT

1. General

The Refuge consists of 211 acres of mostly rocky habitats. SEFI, where all facilities and PRBO staff are located, supports a soil-covered marine terrace. Island flora includes 45-50 species. Rocky habitats provide nesting areas for many seabird species including common murres, pigeon guillemots, and Brandt's cormorants. Soils provide habitat for burrow-nesting species such as

Cassin's and rhinoceros auklets. Rocky habitats are largely undisturbed. However, habitats which can support plant life on SEFI have been significantly impacted by a history of human occupation and disturbance. Many exotic plant species flourish on the island, and in some areas have displaced the native endemic Farallon weed (*Lasthenia maritima*).

3. Forests

The "woodland habitat" on SEFI consists of three Monterey cypress and one low-growing Monterey pine, which are able to tolerate the strong prevailing winds. These small trees serve as veritable magnets to migrant land-birds. During the spring and fall large numbers of migrants can be found in and around these trees, thus facilitating censusing and banding of these birds.

6. Other Habitats

In September 2000, the "Habitat Sculpture" was constructed near North Landing by Meadowsweet Dairy. Concrete blocks were stacked upon one another in an design engineered to create habitat for crevice nesting birds. The Habitat Sculpture contains 32 nesting boxes and an observation blind - biologists can crawl inside the sculpture and monitor the colonization of the newly created habitat through plexiglass windows, without disturbing the birds. In the first year (2001), 9 of the 32 available sites were occupied by Cassin's auklets. In 2002, 12 Cassin's auklet pairs and 1 pigeon guillemot pair nested in the created habitat.

10. Pest Control

FWS personnel and PRBO and volunteers continued to control exotic vegetation, primarily New Zealand spinach (*Tetragonia tetragonioides*), to prevent its encroachment into new areas and reduce its spread in already-infested areas where it covers seabird nesting burrows. August 11-16 marked the 14th year in a row that Refuge staff chemically treated spinach and *Malva spp.* with a 4% Round-up herbicide solution after the seabird breeding season.

Infestation of New Zealand Spinach was slightly higher this year compared to last year, but *Malva spp.* infestation was considerably reduced. About 10% less chemical and person effort was used this year than last year to control invasive non-native plants (163 gallons in 2002 compared to 179 gal. in 2001, and 46 person hours in 2002 compared to 52 in 2001).

Refuge volunteers spent 11 hours pulling seedlings of these invasive plants in the spring.

Invasive weed control efforts were sporadic after the Farallon ROS departed in August. Refuge Manager Joelle Buffa spent 8 person hours spraying 16 gallon of herbicide mix on weedsduring September, and PRBO interns pulled spinach in conjunction with wildlife surveys and other duties throughout the fall. However, since the Farallon ROS position remained vacant through the end of the year, there was not a focused and consistent effort to remove weeds during the fall, as has happened the past two years.

The Refuge will have additional resources for combating weeds in the future. The recently approved Restoration Plan for the Cape Mohican oil spill includes $25,000 per year for the next 5 years to fund non-native plant eradication control on SEFI.

1. Wilderness and Special Areas

In 1973, Middle Farallon Island, North Farallon Islands, West End (part of the South Farallons), and Noonday Rock were designated a National Wilderness Area. The largest island, Southeast Farallon, was excluded from this designation because of the structures and people living on the island. The land area within the Wilderness Area encompasses 141 acres, which serve as marine bird and mammal breeding areas. Periodic monitoring from offshore by boat or by foot is the only management practiced on these islands, therefore the wilderness designation does not affect Refuge operations.

Farallon Refuge Manager, Joelle Buffa and CNO Refuge Supervisor, Dave Paullin attended an 8-day National Wilderness Stewardship Training conducted by the Carhart Center in Tucson during March.

The waters surrounding the Refuge are part of the Gulf of the Farallones National Marine Sanctuary, managed by NOAA, and are also within a State Department of Fish and Game Ecological Reserve. The islands and waters are part of the Golden Gate Biosphere Reserve. The Farallon Islands have been designated as a Globally Important Bird Area by the American Bird Conservancy.

G. WILDLIFE

2. Endangered and/or Threatened Species

a. California Brown Pelican

Brown pelican numbers peaked at 1200 in November (Table 1). The timing of this peak was characteristic of most years, as pelican use is usually concentrated in the fall and winter when birds commonly roost on the islands after dispersing from breeding sites in Southern and Baja California. Year to year fluctuations in numbers are related to water temperature (more pelicans during warm-water years), and the relative abundance of food resources in coastal and offshore zones.

Table 1. Peak monthly population estimates of California brown pelicans on S Farallon Island

Month	1994	1995	1996	1997	1998	1999	2000	2001	2002
January	208	52	320	475	1000	700*	200*	1050	50*
February	78	0	N/A	38	525	500*	6	20*	1*
March	26	81	14	0	213	0	65	83	0*
April	N/A	73	7	1	180	0	26	34	6
May	N/A	14	10	40	455	26*	42	48	9
June	N/A	5*	10	386	1245	41	436	118	5
July	353	464	193	112	300*	300*	300*	238	181
August	409	1200	456	960	810	500*	300*	307	143
September	940	1190	819	3380	2332	728*	1700	970	445*
October	2025	1629	1670	4350	2625	2700	2450	1350	925
November	425	1117	721	3030	2360	1900	663	800	1200
December	N/A	392	460	1500	750*	1000*	650	500	500

*** =Average monthly population** **N/A= Data not available**

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

b. Steller Sea Lion

The Steller sea lion was listed as federally threatened in 1990 due to a 50% worldwide decline between the 1960s and 1989. The South Farallon Island (SFI) rookery and waters around the Refuge are designated critical habitat. Most of the following is based on Hastings and Sydeman (2002).

Counts of Steller sea lions on the Farallon Islands have been conducted since 1927, however standardized annual counts on SFI have occurred only since 1973. The Steller sea lion population has declined on SFI between the 1920s and the present. However, the magnitude and pattern of the decline is complicated by differing census techniques and differing patterns in seasonal trends, age-classes and sexes. The total count of Steller sea lions on the Farallon Islands has declined approximately 80%, from an average of 790 animals from 1927-1947, to an average of 150 animals from 1974-1997. This may be biased because animals on North Farallon Islands were not included in surveys since 1950.

Between 1974 and 1996, numbers of adult females during the breeding season declined approximately 6% per year and maximum pup counts also declined significantly. During this same period, numbers of sub-adult males increased during the breeding season, and numbers of immatures present during the late fall/early winter increased by approximately 5% per year.

A shift in pupping areas on the SFI occurred from 1973 to 1988. From 1973 to 1975 all full-term pups were born on Saddle Rock. From 1976 to 1983 females pupped in Sea Lion Cove, but this site was abandoned in the late 1980's, possibly due to increased diving activity. Pupping was first observed on West End in 1985. Shell Beach and Indian Head on West End are currently the only active rookery sites on SFI.

Steller sea lion natality rates have also declined steadily between 1973 and 1994, exhibiting a low pregnancy rate and high incidence of premature pupping (stillbirths). The premature pupping rate on SFI (30-50%) is extremely high compared to others rookeries (e.g. 2% at Año Nuevo). Twenty to thirty pups were born annually in the late 1970s and early 1980s, compared with an average of five to ten per year in recent times (Table 3). Although pup production may be somewhat underestimated because rookeries are not easily observed from island vantage points, low pup production is evident- only 11% of females give birth on average. With such low reproduction, the status of the Steller sea lions at Farallon NWR remains precarious.

Possible reasons for the SFI Steller sea lion population decline include pollution, human disturbance, over-fishing, increased disease and/or predation on sea lions, and El Niño effects. PRBO's annual monitoring suggests that the 1982-83 El Niño may have affected the number of viable pups cows were able to produce. Studies of possible causes of premature births found that five to seven premature pups sampled died of the influenza virus, and a pollution study found elevated organochlorine and trace metal (Hg and Cu) levels in sea lion tissues. It has been suggested that there may be an interrelationship between increased levels of organochlorines and PCBs and diseases.

3. Waterfowl

Waterfowl are not common on SEFI. Most records consist of duck or goose flocks flying by the island. The emperor goose (named Desmond) that arrived on Christmas day 2001 stayed through March 4. A ring-necked duck observed in May was the second island record. A juvenile female mallard, arriving on the front steps of the house on July 23, was the first duck ever record during the month of July. It hung around the house until a peregrine returned in August and quickly disposed of it. In 1993 a black brant arrived on SEFI and has hung out on the Marine Terrace and Lighthouse Hill,

Molly and gull friend

feeding among the western gulls ever since. Island personnel became quite attached to her, naming her Molly. She was reported missing on June 10, and through the summer it was hoped that she was just vacationing on West End. When trips to West End during the fall and winter failed to locate Molly, the worst was expected. We were particularly anxious because big celebrations had been planned for her 10th anniversary party. So as not to keep the reader in a state of suspense until the next narrative, I happily report that Molly was rediscovered on Marine Terrace on January 31, 2003 (perhaps after learning that the festivities being planned for her 10-year milestone in November did not include a fresh cooked goose dinner).

4. Marsh and Waterbirds

No marsh or waterbirds breed on the Refuge, however PRBO counts wintering and migratory species daily. Black turnstones, willets, whimbrils, and wandering tattlers are commonly seen. Occasionally, rareties show up in fall or spring, such as 3 upland sandpipers on August 17-26.

5. Gulls, Terns and Allied Species (Seabirds)

Farallon NWR is an extremely important breeding site for seabirds. It supports 29% of the breeding seabird population in California and is the single largest seabird breeding colony in the continuous United States. A statewide survey of seabird colonies conducted by the USFWS in 1989-1991 found that the North and South Farallon Island colonies contained the largest seabird population in California, totaling 155,550 breeding birds of 12 species (plus another possibly breeding species). Breeding birds have increased to around 250,000 since then.

The Refuge supports a significant proportion of state's breeding population for 10 species: Leach's storm petrel (11%), ashy storm-petrel (55%), double crested cormorants (11%), Brandt's cormorant (20%), western gull (36%), common murre (19%), pigeon guillemot (12%), Cassin's auklet (68%), rhinoceros auklet (29%), and tufted puffin (25%). The Refuge hosts the world's largest colonies of ashy storm petrel, Brandt's cormorants and western gull, as well as the most southerly colonies of significant size for rhinoceros auklets and tufted puffins on the west coast of North America.

Seabird breeding activities on the Farallon Islands are correlated with the seasonal occurrence of oceanic upwelling off central California. Extended periods of strong northwesterly winds during late winter and early spring promote the upwelling of cold, nutrient-rich subsurface waters. Upwelling stimulates phytoplankton blooms and production of zooplankton and juvenile fish, including sardines, which are the prey-base for the seabirds of the Refuge. Juvenile sardines, an important part of the seabird diet, were over fished in the 1940s and disappeared from the Farallon food chain. Juvenile sardines returned to Farallon waters in the early 1990s.

Seabird populations and productivity of 11 species were monitored by PRBO by cooperative agreement and results are shown in Table 2 below.

Table 2. South Farallon Breeding Seabird Populations

	1996		1997		1998		1999		2000		2001		2002		1992-2001
SPECIES	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**BP**	**YF**	**Avg. Breeding Population**
Ashy storm-petrel [1,2]	2661[3]	0.53	2661[3]	0.78	2661[3]	0.52	2661[3]	0.74	2661[3]	0.67	2661[3]	0.56	2661[3]	0.55	N/A
Double-crested cormorant	444	N/A	188[5]	N/A	330	N/A	468	N/A	402	N/A	402	N/A	486	N/A	436
Brandt's cormorant[1]	8,074	8,437	7,490[5]	7,003	5,092[5]	1,069	6,345[5]	7,614	5,896[5]	6,692	6,570	6,504	9,466	9,513	6,946
Pelagic cormorant	374[5]	47	316[5]	144	164[5]	5	222[5]	141	260[5]	159	416	470	442	572	348
Black oystercatcher	12	9-27	22	14	18	10	30	26	26	N/A	30	6	22	10	20
Western gull[1]	20,815	5,412	23,807	7,142	19,707	5,124	19,767	3,063	15,544	4,818	18,235	2,918	15,095	7,095	20,233
Pigeon guillemot	728	164	1,273	433	294	7	468	267	568	335	502	331	499	365	784
Common murre	65,400	19,293	61,089[5]	24,130	52,670[5]	10,271	58,878[5]	24,082	53,301[5]	21,853	68,194[5]	27,619[4]	103,588	39,881[4]	56,215
Cassin's auklet[2]	23,668	9,586	26,892	7,395	10,458	4,131	15,239	6,324	15,239	6,324	16,690	8,762	18,807	11,096	20,910
Rhinoceros auklet[2]	±1000[4]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.66[6]	N/A	0.64[6]	N/A	0.62[6]	N/A
Tufted puffin	92	N/A	130	N/A	50	N/A	118	N/A	74	N/A	102	N/A	128	N/A	100

*BP= Breeding population; YF= Number of young fledged; N/A= Data not available.

(1) Farallon National Wildlife Refuge contains the world's largest breeding colony for species.
(2) Estimates from Southeast Farallon Island only.
(3) 1992 Estimate (Sydeman et al 1998). More recent population estimate not available.
(4) Murre chicks fledged/pair based on pooled data from 3 productivity plots.
(5) Population estimate from land based survey only. No boat survey conducted.
(6) Young fledged includes relays. For ashy storm-petrel and rhinoceros auklets, figure is young fledged/pair.
NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite

Productivity of seabirds on SEFI during the 2002 breeding season was higher than the long-term average for all species except western gulls and ashy storm-petrels, and exceptionally high for cormorants, guillemots and Cassin's auklets. Mean seasonal sea surface temperatures (SST) from March to August was cold, approximately 1 °F cooler than the 31-year average of 53.5 °F for these months. Low SSTs are correlated with high ocean productivity, so it is not surprising that seabirds did well. Other indicators of a productive breeding season were second broods for Cassin's auklets, and the increase of juvenile rockfish in the diet of rhinoceros auklets, pigeon guillemots and murres for the second consecutive season after the near absence of these cold-water prey during the past decade. This is the fourth highly productive seabird year in a row.

Breeding population sizes were higher than the 2001 estimate for all species except western gull (17% lower), black oystercatcher (26% lower) and pigeon guillemot (about equal), and were lower than the 10-year average for pigeon guillemot and Cassin's auklet. For the first time since 1996, the boat portion of the census was conducted for common murre and Brandt's cormorant during 2002. Since these two species cannot be adequately surveyed from ground surveys only, part (but not all) of their population increase over 2001 numbers can be attributed to a more complete survey.

The **ashy storm-petrel** was listed by the USFWS as a Category 2 species under the ESA in November 1994. However the USFWS discontinued all Category 2 designations in February 1996. The ashy storm-petrel is currently considered a "species of concern", with no status under the ESA. Prompted by the potential listing, PRBO undertook a population viability analysis of the species. This analysis concluded that the population is not in imminent danger of extinction, but should be considered threatened. Given current population parameters and predation rates, the population faces high probability (~45%) of being quasi-extinct within 50 years.

The SEFI **ashy storm-petrel** breeding population was estimated at 2661 for 1992 by PRBO from capture/recapture data (Sydeman et al. 1998). A population estimate of ashy storm-petrels more recent then 1992 cannot be made until data from continuing mark/recapture study are analyzed. Comparing 1972 and 1992 population estimates shows 35% - 40% overall population decline of breeding birds. The 2.87% per year decline roughly equals the number of predated ashy storm-petrel carcasses observed annually. This predation rate on adults of such long lived, slowly reproducing species is considered significant. Recently, collection of petrels wings was standardized to better determine the number killed per year. In 2002, 135 wings were collected, representing an estimated 90 individual petrels. Gulls and burrowing owls are the main predators.

Introduced house mice may also be partly responsible for petrel declines. In 1997 and 1998, petrel eggs were found in monitored nests with evidence of mouse predation. A quail egg study (see Section D.5) initiated in 2002 revealed no signs of mouse predation. However, several potential weaknesses were identified: the track plate medium (chalk) may not be sensitive enough to detect mice and tiny mouse tooth marks may not show up on quail eggs. Modifications will be made next year to resolve these shortcomings. House mice may have a more serious indirect effects on petrels by enticing owls that predate seabirds to over-winter (Section G.6)

The most interesting petrel news was a 30+ year old ashy storm-petrel (band #111-11673) caught in a mist-net in July. It was banded as a breeding adult on May 29, 1973. This old bird broke the SEFI longevity record previously held by a western gull (last sighted in 2000).

There has been a substantial decline of breeding **Brandt's cormorants** on SEFI compared to population sizes in the early 1970s. In 1971-1977, breeding number exceeded 20,000 in four of seven years, but after 1978 they never reached this level. In 1983, the breeding numbers dropped markedly, and again recovered one to two years later, but not to the levels achieved before that drop. However, since 1985 the breeding population has maintained a fairly level or slightly increasing trend, without further drops. Observed declines may be partially, but not totally, due to colonies shifting closer to the mainland.

Population size of Brandt's cormorants in 2002 was 44% higher than the estimate for 2001, and 36% above the 10-year average (Table 2). Several newer colonies expanded, and a large influx of breeding birds from the 1999 and 2000 cohort were observed. The population estimate is based on ground surveys conducted May 31, June 2 and 10, and a boat survey conducted June 13. The Cormorant Blind colony produced 2.01 fledglings produced per pair, which is 40% higher than the 30-year average (Fig. 1). Mean clutch size was 3.20 eggs per nest and hatching success was 87%. Fledgling success was higher than last season, with 88% of the chicks that hatched surviving to fledge.

The **double crested cormorant colony** is located on Maintop on West End. On 31 May, a peak number of 243 well-built nests with birds in incubation posture were counted. Multiplying this count by 2 yields a breeding population of 486 birds. This estimate is 21% higher than 2001, and about 11% higher than the 10-year average (Table 2). No reproductive data is collected on this species due to poor visibility of double crested cormorant nests.

The **pelagic cormorant** breeding population was 12% higher than the 10-year average. The estimated 2002 breeding population of 442 birds was 6% higher than the 2001 count and 27% higher than the 10-year average. Ground census was conducted on June 13-14, and the boat portion was completed on June 13. Pelagic cormorants produced 2.59 fledglings per pair, which is the highest ever recorded on SEFI for this species (Fig. 1). The average clutch size was 4 eggs per nest. Hatching success was 63%, and 99% of the chicks that hatched survived to fledge.

The **western gull** breeding population size of 15,095 birds was 17% lower than in 2001 and 25% below the 10-year average (Table 2). Western gull productivity has shown a steady decline through time (Fig. 1). However, productivity in 2002 was three times higher than in 2001, and the highest observed since 1991. Mean clutch size was 2.78 eggs per nest, and the number of chicks fledged per pair was 0.94. Out of the 74% of eggs that hatched, 43% of the chicks survived to fledge.

The peak count of 499 **pigeon guillemots** on 17April was approximately equal to 2001, but 36% lower than the 10-year average (Table 2). This breeding population estimate was derived by counting adults rafting on the water around SEFI at dusk through the month of April, before the birds begin attending their nesting sites. This methodology is consistent with how previous population estimates shown on Table 2 have been made. However, over the last two seasons,

much higher numbers of guillemots have been counted on the water in early morning, prompting the initiation of early morning raft counts. The peak of 1,964 pigeon guillemots counted on April 21 may more accurately reflect the number of birds using the island. This number is also similar to the peak numbers observed around the island in the late 70s and early 80s.

Pigeon guillemots were monitored at 138 sites on Lighthouse Hill, Garbage Gulch, and the Habitat Sculpture, of which 82 were observed with at least one egg (59% of total monitored sites). This was one of the best years on record for pigeon guillemots, with 1.64 fledglings produced per pair. This is 11% higher than last season and 65% higher than the 31-year average (Fig. 1). The mean clutch size was 1.95 eggs per nest and 89% of the chicks hatched successfully. Fledging success was also high, with 83% of the chicks surviving to fledge.

The South Farallon Island **common murre** 2002 population estimate of 103,588 is the highest in over a century. This estimate is derived from ground and boat-based surveys conducted by PRBO, and is 52% higher than in 2001. Although the common murre population is undoubtedly increasing, it is likely that more of an increase has occurred over the last few years than is shown on Table 2. The increase was not fully accounted for until 2002 because this is the first year since 1996 that the boat based portion of the survey was conducted A correction factor to account for areas not counted by boat was applied to 1997-2001 population estimates, however these correction factors did not accurately reflect the more rapid growth of the murre population on West End. The boat-based portion, which surveys areas on West End and other islets not observable from island observation points, was conducted on 27 May 2002.

Aerial surveys conducted by USFWS on 28 May came up with the following murre breeding population estimates: South Farallon Islands = 116,892; North Farallon Islands = 66,478. These estimates were derived from applying a correction factor of 1.54 (used for PRBO's population estimate) to the raw numbers counted: 75904 and 43,135, respectively for South and North Farallons. These numbers are preliminary and may change upon further analysis.

Common Murre colony on Shubrick

These increases leave us hopeful that the common murre population is finally recovering from declines that occurred in the mid 1980s through mid 1990s, due mainly to the combined effects of gill-net caused mortality, the El Niño Southern Oscillation (ENSO) event, and oil spills. Closing of the near shore gill-net fishery in late 1987, the return of colder water, and the comeback of juvenile rockfish resulting in increased murre productivity, are explanations for the murre recovery. The overall production estimate of 37,809 fledglings for South Farallon Island is based on productivity data pooled from three plots (Upper Shubrick Point (USP), Upper Upper and X); previous years' fledgling data were extrapolated from the USP plot only. Warzybok et al 2002 contains more details on seabird populations and reproduction.

The SEFI **Cassin's auklet** breeding population estimate is considered very rough, and is based on counts of burrows and crevice nesting sites. Population censuses are very difficult due to the bird's nocturnal behavior and burrowing nesting habits. The most recent complete survey of all burrows and crevices on South Farallon Islands conducted by USFWS in 1989 produced an estimate of 29,880 breeding birds on SEFI (38,274 for all South Farallon Islands). A burrow occupancy rate of 75% was used as a correction factor. Since 1991, PRBO has monitored Cassin's auklet burrows and crevices in twelve index plots on SEFI in order to detect population trends. The difference in index plot burrow density each year is applied to the 1989 USFWS population estimate to roughly estimate the current year's population. The SEFI 2002 breeding population was estimated at 18,807 birds. This is 13% higher than 2001, but still lower than the 10-year average. (Table 2).

Cassin's auklets on the Farallon Islands have been declined considerably since 1971, and although burrow counts in index plots for 2002 were 12% higher than in 2001 (and have increased for the past three years, they are still well below the numbers observed prior to 1998. The 1989 USFWS breeding population estimate of 29,880 was significantly lower than the estimate of 105,492 Cassin's auklets breeding on SEFI in Manuwal's 1971 study. This decline may be exaggerated due to differences in census methods and occupancy correction factors used in the two studies. Possible causes are increased predation by western gulls, owls and peregrine falcons; decline in suitable burrow sites; changes in prey availability; and oil spill mortality.

Occupancy of breeding Cassin's auklets in boxes was high again this year, with 89% of the 44 boxes occupied. Productivity was exceptionally high for the second year in a row, with 1.18 chicks fledged per pair (including second broods and relays- See Table 2). This is 61% higher than the 31-year average and the **highest productivity ever recorded for Cassin's on SEFI.** 74% of the eggs hatched and 93% of these chicks were able to fledge successfully. Cassin's began nesting very early and many re-nested, raising second broods. Fifteen pairs out of 21 attempts (in monitored boxes) were successful at raising second broods; if this figure is extrapolated to natural crevices, one-third of the population may have raised second broods.

Rhinoceros auklet population size could not be estimated due to difficulties in censusing this crepuscular, burrow-nesting species. Rhinoceros auklet pairs bred in 39% of 150 monitored sites (boxes, crevices, and cave sites). An explanation for the apparent decline in occupancy (which was 57% in 2001) is that only one of the 40 additional boxes deployed during 2002 was used.

Auklets produced 0.62 fledglings per pair, which was 10% higher than the 16-year average (Fig. 1). 76% of the chicks successfully hatched, and 80% successfully fledged.

Tufted puffin estimate breeding population of 128 birds is approximately 28% greater than the 10-year average. Population size is based on the number of occupied breeding year sites observed during two 1-week periods (early May and mid-July). Productivity cannot be estimated due to the inaccessibility of nesting crevices.

Black Oystercatcher breeding population is estimated by censusing all known breeding sites visible from Lighthouse Hill, the Marine Terrace. The estimate does not reflect birds on parts of the islands not visible from the SEFI vantage points. Of the 31 sites that were monitored this year, 11 were attended by a breeding pair which had eggs and/or chicks. This estimate is 26% lower than last season, but slightly higher than the 10-year average(Table 2). Oystercatchers produced 1.1 fledglings per pair, a 65% increase over the productivity of 0.28 observed in 2001. Black oystercatcher nests are cryptic and difficult to observe, therefore clutch size and hatching success could not be estimated.

Oiled Birds: For over a decade, winter storms have coincided with large numbers of oiled birds found washed ashore or swimming in waters around the Farallons Islands. In February 2002 the source of this oil was finally discovered by comparing samples from oiled birds and oil from a sunken ship, the SS Luckenbach (see Section J.2). In January and February, 48 and 16 oiled birds were observed, respectively. Only a few oiled birds were seen through the spring and summer, with the exception of June when a dozen oiled seabirds were found. About this time there was a release of oil during the Luckenbach clean-up operations. Everyone prematurely cheered when the Luckenbach clean-up was "completed" in October. During November and December, 77 and 28 oiled birds, respectively, were observed from the island. This raised concerns about the 30,000 gallons of oil left "sealed under sediments" in the Luckenbach's tanks . Common murres comprised over 90% of the oiled birds, but other species included brown pelican, western gull, pigeon guillemot, pelagic cormorant, rhinoceros auklet, pacific loon, and burrowing owl.

On a brighter note. One oiled banded common murre was recovered alive during the winter and sent to the Oiled Wildlife Care Network for rehabilitation. After being released it returned to its regular breeding location and raised a chick to about 10 days of age. The chick was taken by a western gull. (Well, it started out as a good news story.)

6. Raptors

One to three peregrine falcons were present throughout the fall, winter, and early spring months, August through April. Peregrine falcons feed primarily on Cassin's auklets and common murres at sea near SEFI, based on numerous carcasses found at island feeding sites. Several peregrine-killed rhinoceros auklets were found in February.

Only one burrowing owl was present September through December, which is atypical. Usually 8 arrive per year and an average of 3 per year over-winter. Capture, banding, and release studies have shown these to be young-of-the-year birds. They are most likely dispersing juveniles that

arrive during fall migration and stay because of the abundant food supply (non-native house mice peak in the fall). After winter rains cause the house mouse population to crash (burrows are flooded), most of the owls either starve or are killed by gulls. A growing concern is that wintering burrowing owls (and to a lesser extent other owl species) begin preying on ashy storm-petrels and Cassin's auklets (2 declining seabird species) once the mice are hard to find.

In Spring 2000, a standard protocol for collecting owl pellets was implemented on SEFI . In July 2002, Kyra Mills analyzed 397 owl pellets from four owl species collected thus far: burrowing, barn, long-eared and saw-whet. Mice were the predominant prey species found in pellets, but birds of several different species occurred in 39% of the pellets. Cassin's auklet and ashy storm-petrel were the bird species most frequently found in pellets. Pellet composition varied between owl species. Burrowing owls take the most ashy storm-petrels compared with other owl species. Barn owls take a greater number of Cassin's auklets than mice. Pellets collected from one individual long-eared owl (on SEFI during winter 2000) and one saw-whet owl (on SEFI early winter and early spring 2002 contained almost all mice, which occur in greater abundance during the time that these individual owls were present.

Figure 2, which shows pellet composition by time of year, affirms our hypothesis about the seasonal diet switch to seabirds. Between August and March, mice compose a higher percentage of pellets (>85%), with a lower incidence of petrels, auklets, and insects. Between April and July, when mice are scarce or more difficult to find, and more seabirds are found on the island, the incidence of birds in pellets increased to nearly 70%.

7. Other Migratory Birds

Southeast Farallon Island is a place well known for the number and diversity of landbirds that show up on the island. Many of these landbirds are common western birds migrating either north in the spring or south in the fall. However, the birds that attract the most attention are eastern vagrants, common elsewhere in the country but not normally found on the west coast or in California, or vagrants from other continents. Most vagrants that have been captured and aged on the Farallon Islands juvenile birds. Over 400 species of birds have been recorded for the Farallon Islands.

There are no resident landbirds on the Refuge. Migratory birds have been censused daily on SEFI since 1968. Analyses have shown that landbird populations show more declines than increases, reflecting Breeding Bird Survey data for the western US.

Noteworthy birds observed this year included an alder flycatcher in October, an eastern US migrant; and little bunting in September, an Asian species. The bunting was number 403 for the Farallon species list. Fall 2002 was a poor year for eastern warblers.

9. Marine Mammals

Weekly all-island pinniped counts of haul-out areas on South Farallon Island (SFI) are conducted throughout the year. Maximum populations and breeding success for the five pinniped species using the South Farallon Island during the last nine years are shown in Table 3. Average monthly numbers of pinniped populations for the past three years are shown on Table 4.

Guadalupe fur seal sightings are not included on Table 3. One or several animals have been observed each year in early fall or winter since the first historic sighting of this species in September 1993.

Table 3.-(A) Maximum Population Numbers (Peak Monthly)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
California Sea Lion	3883 (July)	3416 (May)	4594 (May)	4303 (Aug)	4990 (July)	7837 (Oct)	5270 (Jan)	2423 (Sept)	3301 (Aug)	4480 (June)
Steller Sea Lion	118 (Dec)	187 (Oct)	138 (June)	213 (Nov)	148 (Nov)	253 (Dec)	133 (Oct)	174 (July)	261 (May)	304 (Nov)
Harbor Seal	170 (Sept)	122 (Feb)	151 (Mar)	144 (Sep/Oct)	141 (Sept/ Nov)	190 (Feb)	125 (Feb)	128 (Dec)	150 (Dec)	168 (Jan)
Northern Elephant Seal	790 (May)	838 (Apr)	532 (Apr)	590 (Jan)	571 (Nov)	406 (Jan)	623 (Nov)	1019 (Nov)	843 (Oct)	736 (Nov)
Northern Fur Seal	3 (O ct)	2 (Mar)	3 (Aug)	10 (Aug-Oct)	8-12 (Sept)	4 (Nov)	22 (Aug)	13 (Sept)	18 (Sept)	35 (Sept)

Table 3.-(B) Number of Pups or Pups/weaners Produced

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
California Sea Lion	1	2	3	16	0	31	17	33	12	13
Seller Sea Lion[1]	4	5	5	5	4	10	11	9	11	7[4]
Harbor Seal	N/A	N/A	1	1	2	4	2	1	1	3
Elephant Seal[2]	329/216	287/183	299/188	308/232	274/211	250/192	198/158	174/127	156/139	136/115
N. Fur Seal[3]	0	0	0	1	4	1	3	4	5	13

N/A= Data not available

[1] Maximum numbers of pups observed during any one June/July census.

[2] Number of pups born/number pups weaned

[3] Number of pups observed during August visit to West End.

[4] Number of pups counted by NMFS aerial census

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

Table 4. Average Monthly Pinniped Numbers - South Farallon Island

	CA Sea Lion			Steller's Sea Lion			Harbor Seal			Elephant Seal			N. Fur Seal		
	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002	2000	2001	2002
JAN	800	1500	1750	30	43	50	90	125	168	200	275	275	2	1	1
FEB	600	750	1000	20	20	35	100	100	150	200	225	182	0	0	2
MAR	222	570	320	16	31	24	75	108	125	95	157	110	0	0	1
APR	501	340	1084	27	50	95	83	96	64	330	468	451	0	0	0
MAY	1039	1428	3393	39	132	104	39	70	57	425	390	347	0	0	1
JUNE	686	1452	3760	101	108	93	55	85	81	72	73	46	2	5	2
JULY	1658	2439	2600	89	92	70	102	74	95	17	24	20	5	6	3
AUG	1450	2985	1388	39	63	13	97	79	57	114	53	47	0	0	1
SEPT	1929	1220	1462	50	76	60	47	66	43	322	500	348	11	11	12
OCT	1815	1356	1488	54	110	90	69	55	94	772	668	556	4	6	3
NOV	1529	1850	2164	91	134	158	63	57	85	763	543	582	1	0	1
DEC	1250	2000	2500	35	40	50	120	150	N/A	375	225	N/A	1	0	0
TOTAL **Avg/Mo**	13479 1123	17888 1491	22909 1909	591 49	899 75	842 70	940 78	1065 89	1019 85	3685 307	3601 300	2964 247	26 2	29 2	27 2

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.
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The National Marine Fisheries Service Southwest Fisheries Sciences Center analyzed pinniped population trends in the Gulf of the Farallons during the period 1973 to 1994. Some of the following discussions is based on the report prepared by Sydeman and Allen (1996).

California sea lions, primarily immatures, haul-out on SFI year-round. They are the most abundant species of pinniped on the Refuge. Sea lions numbers increased significantly at SFI between 1973 and 1994, at an average rate of 6.4% per year. Peak California sea lion abundance was observed in the years of the 1983, 1992, and 1998 El Niño Southerly Oscillation (ENSO) events. Most California sea lion young in California are produced south of Point Conception, with the Farallons representing the northern breeding limit for the species. Prior to 1998, only a few pups are born on the Refuge each year, but more pupping has occurred since the 1998 El Niño.

In contrast to the California sea lion, the Farallons are near the southern breeding limit of the **Steller sea lion**, which pups only as far south as Año Nuevo. Steller sea lions breed in small numbers in spring and summer (May through August) on the South Farallon Islands, and haul-out in larger numbers throughout the year. Births occur from late May through mid-July and copulation occurs 1-1/2 to 2 weeks after postpartum. Females typically return to the same

pupping site in successive years. It is possible that pupping and breeding occurs on North Farallon Island, as Steller sea lions have been observed there, but data is lacking.

The average number of Steller sea lions on SFI during 2002 was 70 (Table 4). The peak number of Steller sea lions counted during the breeding season was 143 in May. The high count of pups counted from mainland vantage points in July was 6, however the National Marine Fisheries Service counted 7 pups on a July 9th survey. Their remote rookery location on West End makes it difficult to monitor reproductive success from land.

Another influx of Steller sea lions occurs on SFI in the fall (September to December) when mother-pup pairs from Año Nuevo haul-out on SFI.. Fall numbers peaked at 304 in November.

Pacific harbor seal populations on SFI grew at an annual rate of 10.4% between 1973 and 1994. This increasing trend is probably explained by poor food availability which has forced seals to leave their coastal foraging grounds and search for food in more pelagic waters. Marked peaks in abundance occur during ENSO such as 1998 when an all-time high of 190 harbor seals were counted (Table 3A). Harbor seals occasionally pup on SFI, and three pup was noted this year.

It is estimated that over 80,000 **northern fur seals** used the Farallons during the breeding season prior to the arrival of American and Russian sealers in the 1800s. This species was extirpated from the Farallons due to intensive hunting in the early 1800s, and until 1996 northern fur seal use consisted of immatures occasionally being seen around, or hauled out on, the island. In 1996 the first fur seal pup was recorded on West End. Until this historic Farallon birth, northern fur seals were only known to breed in Alaska and the Channel Islands in North America.

Thirteen northern fur seal pups were observed on West End this year (Table 3B). The breeding site was located in the same area previous years: In Upper Mirounga Valley near Pastel Cave Highlands. Since pupping sites are not visible from land or sea vantage points, pups can only be monitored by accessing West End on foot in the early fall after seabirds have left their breeding sites.

Elephant seals were also extirpated from the Farallons, but returned in 1959 and began breeding on SFI again in 1972. Elephant seal births between 1973 and 1983 followed a pattern of exponential growth, increasing at a rate of 56.5% per year. The SFI population apparently reached carrying capacity in 1983, and between 1983 and 2000 the number of pups produced declined an average 3.5% annually. In 1983, a peak of 475 pups were born, compared with an estimated 136 births during the 2002 season. The number of adult bulls and cows Associated with the decline in production, is also a decline in the number of (Table 5).

It is thought that the major reason for this decline is deterioration and erosion of beaches that are important pupping areas. In the 1980s, major elephant seal breeding activity shifted from the Sand Flat on SEFI to Shell Beach on West End after severe winter storms in 1983 eroded the Sand Flat Beach and access routes. Winter 1997-98 El Niño storms severely eroded sand on the Shell Beach

Jerry Nusbaum tagging elephant seal in late 1970s. Note sandy beach which is now rocky

access route, leaving a series of steep rocky cascades. After 1998, numbers of cows using Shell Beach declined dramatically, and the numbers of cows pupping on SEFI increased compared to the 90's. Breeding elephant seal breeding activity is now more evenly distributed between SEFI and West End.

Table 5. Elephant Seal Breeding Activity - South Farallon Island

YEAR	Cows	Pups	Weaners
1993	503	329	216
1994	415	287	183
1995	406	299	190
1996	348	82	231
1997	309	274	210
1998	289	250	192
1999	178	198	158
2000	199	174	127
2001	168	156	139
2002	158	136	115

NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.

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Reproductive success of elephant seals was monitored daily at four Southeast Farallon Island sub-colonies and during10 visits to the two West End sub-colonies. The first pregnant elephant seal cow of the 2001-02 season arrived on December 8th , 2001. The first pup of the season was born on December 15, 2001.

In summary, breeding dynamics of elephant seals on SFI have changed, primarily due to beach erosion. Wave action and heavy use by pinnipeds have caused sand to wash away. Competition for space with California sea lions may also be a contributing factor in this decline. It is possible that

the increase in elephant seal numbers reported from Pt. Reyes Headlands might reflect the displacement of Farallon island elephant seals.

PRBO has been collecting information on **cetacean** numbers, as observed from SEFI, since 1973. Observations of most species have increased, probably due to population increases of some species (e.g., gray, blue, and humpback whale), increased effort, and observer bias (PRBO personnel have possibly become better at sighting whales). Gray whales are commonly observed migrating during winter months, southbound in January and northbound in March. One gray whale was seen almost daily at East Landing, or feeding around the island, from mid March to early August.

Other species observed during 2002 were blue, humpback, fin, Minke and orca whales; Pacific white-sided and common dolphins.

11. Fisheries Resources

During 2002, PRBO investigators recorded 56 white shark predation events. Prey species identified during 28 of the 58 events were: 23 immature elephant seals, 4 California sea lions and 1 harbor seal. An estimated 20-25 different individual white sharks were identified during fall.

Information from the 10 white sharks satellite-tagged in 2001 near the islands indicated that the sharks had traveled far out into the Pacific and dove as deep as 700 m. One shark (Tipfin) that went to Hawaii in spring 2001 was re-tagged in fall 2001 and returned to Hawaii again in spring 2002. A total of 17 sharks have been tagged with pop-off satellite transmitters during the first 4 years of the study.

2002 was dubbed the "year of the jellies". Large aggregations of jellyfish were observed in January and March, and included several different species. Numbers were estimated from several thousand to hundreds of thousands on some days. Some jellyfish, such as *Chrysaora melanaster* are particularly impressive because they are over 10 feet in diameter with 2-3' long tentacles.

12. Wildlife Propagation and Stocking

Occasionally the Marine Mammal Center (MMC) releases rehabilitated animals in waters around the Refuge. One California sea lion that had been released by the MMC near the Farallons on September 15 after recovering from a shark bite, showed up at the Dumbarton fishing pier in Fremont on October 23. He was identified by the shark bite scar and orange flipper tag. He had been released at the Farallons a total of two times, so he seems to be trying to escape the sharks!

Farallon released seal caught on tape at Dumbarton fishing pier

15. Animal Control

The Refuge and PRBO continued planning and data collection for a project to eradicate non-native house mice from SEFI because of their adverse affects on the natural ecology (Section G.6). Monthly or bi-monthly snap trapping to document the house mouse population cycle (*Mus musculus*) continued. A total of 503 mice were caught and removed during fiscal year 2002.

16. Marking and Banding

Banding and/or color marking of seabirds, landbirds, and elephant seals are conducted on a large scale by PRBO. 3,184 seabirds and landbirds of 101different species were banded in 2002. Since 1971, western gulls and Brandt's cormorants in study plots have been banded with U.S. Banding Lab metal and colored bands. Common murre chicks in the Upper Upper colony are banded in July. Pigeon guillemot, Cassin's auklet, and rhinoceros auklet chicks are banded in monitored nest box/natural burrow sites with metal and/or color bands. Rhinoceros auklet adults are banded when captured in mist nets during diet studies. Since 1992 a mark/recapture study has involved mist-netting and banding ashy storm-petrels and Leach's storm petrels with metal bands. Some individual birds have been followed as nestlings through 20 years or more of life by reading numbers on metal bands. Valuable information is being obtained in the breeding success of known age birds, and in relation to adverse environmental conditions and other factors.

Elephant seals are tagged with two numbered pink plastic tags on the hind flippers. These animals can then be identified on the Refuge and at other sites in California, and provide information about longevity and movements. Farallon-born elephant seals have been observed at haulouts on San Nicholas Island, San Miguel Island, Año Nuevo and Castle Rock NWR in California, and on Isla San Martin, Baja Mexico.

17. Disease Prevention and Control

Botulism-killed western gulls are seen periodically throughout the year. It is assumed that they contract the disease while feeding in mainland dumps.

Pinnipeds with materials such as packing straps, monofilament, and salmon lures constricting their necks or other body parts are often observed hauled-out on the Refuge. Typically, 45-60 "ringed" pinnipeds are observed per year. The vast majority (around 90%) are California sea lions, but northern elephant seals, Steller's sea lions, and harbor seals are sometimes encountered (Hanni and Pyle. 2000). In 2002, 65 , "ringed" pinnipeds were observed. All but two (elephant seals), were California sea lions.

H. PUBLIC USE

1. General

The Farallon National Wildlife Refuge is closed to the public. However, sightseeing boats cruise the waters around SEFI to observe mammals and seabirds. Boats were recorded during most

months, although peak numbers visited in late summer and the fall. A total of 97 sightseeing boats with an estimated 3716 people on board were recorded during the 2002.

Media visits offer additional opportunities to educate the public about Refuge wildlife. In June and July, BBC journalists and photographers visited the island on one-day visits to film parenting behaviors of western gulls. The resulting educational film, *Super Mums,* which contrasted diverse parenting strategies, was televised on Mother's Day 2003. A PRBO director, Harriet Heyman, was inspired to write an article after a VIP visit. It was published in the *Denver Post's* Travel Section in April. In summer, Barbara Munker wrote an article about the Farallons for the German Press Agency.

7. Other Interpretive Programs

Ten thousand copies of the new Refuge brochure, with a tufted puffin on the cover, were received in November. A supply was sent to PRBO, GFNMS visitor center, and the Oceanic Society, who will send them to Farallon Natural History Cruise participants. An article on the Farallons appeared in the Spring 2002 issue of *"Tideline"*, as part of the Complex's centennial series.

During 2002 the Refuge Manager made two presentations on "Seasons and Seabirds of the Farallon Islands: Fremont Library Group in April and Golden Gate Audubon Society in November.

17. Law Enforcement

USFWS regulations prohibit wildlife disturbance. Low level flights (below 1000') frequently flush wildlife so aircraft flying under 1,000' over the island are treated as potential violations. Two private aircraft flew below 1,000 feet over the Refuge and flushed wildlife during 2002. One of these was a plane conducting pinniped surveys, and a solution to avoid future disturbance was worked out with the pilot. The National Guard Helicopter in February and one USCG helicopter flushed seabirds while delivering personnel to the island, and the pilots were reminded of the correct flight pattern.

The enforcement case (USA vs Gary Shape) against the helicopter pilot cited for disturbing nesting seabirds on SEFI during 2000 was successfully resolved in November 2002. In lieu of a fine the pilot posted outreach material at 13 Bay Area airports. The outreach material included a map showing significant seabird colonies and an information sheet on how to avoid aircraft impacts to wildlife. Fewer aircraft disturbances have been noted the past two years, perhaps as a result of this and other outreach efforts undertaken by Complex personnel.

Jet skis have been banned in the GFNMS since October 2001. The waters within one nautical mile of the Southeast and North Farallon Islands have been established as California State Ecological Reserve, and boating restrictions prohibit boats within 300 feet of most of the shoreline between March 15 and August 15 (Section 630 (b) (71), Title 14, California Code of Regulations). Eight boats were documented violating the seasonal boat closure area. California Dept. of Fish and Game enforces closure violations occurring between March 15 and August 15.

I. EQUIPMENT AND FACILITIES

1. New Construction

Howard Cotner (FWS-RO) conducted the Refuge's first Real Property Inventory in August. A number of facilities were added as "real property" as a result of his island visit, including septic system, communication system, utility lines, trails, and helicopter pad. While this really isn't new construction, it's the first time they have been officially entered into the real property database.

2. Rehabilitation

Water System: During the "2001/2002" rain year (November 2001 - April 2002) 49,625 gallons of water were "harvested" during the collection system's fourth year of operation. This compares with 51,500 gallons in 2001, 29,830 in 2000, and 38,000 gallons in 1999. Water samples are taken 3 times during the year and tested by Alameda County for coliform and nitrates. Coliform continues to test negative.

The water collection, treatment, and distribution system was uncharacteristically flawless this year. Only minor repairs were needed, including: 1)Demand pump was inspected and tested; 2) Clogged ozonator lines and check valves cleaned of debris; 3) Replaced ballast in UV filter; and 4) Painted water tank support beams.

East Landing Derrick: Chronic problems continue with the boom tip sheave, which insists upon sticking despite our best efforts. In 2001, the galvanized steel boom tip sheave was replaced with a stainless steel one to eliminate the need to paint it (layers of paint were thought to cause binding). In July it was noted that the sheave was rubbing on the left side of the boom, but the reason for this could not be diagnosed. In desperation, gulls were blamed. The boom tip is a preferred perch, and the sheave is a repository for their guano. Bird spikes were installed during AC3's maintenance visit to deter perching gulls. In October, an electrical problem in the control box caused a breakdown which was temporarily fixed by PRBO biologist-in-charge Adam Brown, who later authored a helpful troubleshooting section for the Operations Manual. AC3 corrected the problem, and completed other maintenance on sheaves and brakes during their annual inspection in late October.

Residences: Persistent phone calls and letters from the Refuge and Regional Office Contracting Officer finally persuaded the contractor, Karroth Construction, to repair roof damage caused by high winds in December 2001. Bill Dunn and an assistant replaced shingles on the FWS and Coast Guard houses September 18-19, 2002. We are cautiously optimistic that this will put an end to the chronic shingle-failing problem that has plagued the roof since its installation in December 1999.

Only minor tweaking was needed to keep the Webasto heater, Wolf stove, and gray water collection system operating smoothly: 1) Replacing filters and cleaning carbon from combustion chamber of Webasto; 2) Cleaning carbon build-up from the Wolf stove and developing safer lighting procedures; and 3) Reinforcing the gray water system line with stainless steel screws.

Sanitary Waste Treatment System: Alternatives to the not-so-well-loved composting toilet are being investigated. Peter Lescure, a civil engineer specializing in wastewater management, made a pro bono trip to the island in August to evaluate our options for treating and handling sanitary wastes. His reported concluded there are no easy answers. Rocky soil and complicated logistics preclude use of a conventional septic system.

4. Equipment Utilization and Replacement

Generators/Fuel: It should be considered a minor miracle that nothing but routine maintenance was required to keep the Lister generators running smoothly. A diesel fuel sample was tested by Chevron and determined to be stable and free of contaminants.

Outboard Motors/Boats: A new 15' Boston Whaler with rated lifting eyes and a 4-point stainless steel cable harness replaced the old 13' Whaler in July. Lifting eyes on the existing Whaler were becoming a concern, but the boat is still serviceable so it was brought back to Fremont.

5. Communication System

Peter Elke, the Refuge's volunteer communication guru, made a fine presentation on options for upgrading the island's radio, telephone, and e-mail/internet capabilities at the annual coordination meeting in December.

6. Energy Conservation

March marked the 4-year anniversary of operating the field station on solar power. Performance continues to exceed expectations. Solar power supplied over 90% of the Refuge's power needs, and saved at least 5,000 gallons of diesel fuel during its 4th year of operation. Fuel consumption during the 3rd year of solar operation was 619 gallons (compared to 600, 980, and 546 gallons used the first, second, and third years, respectively).

Applied Power made minor adjustments to the P-V system during their annual service visit in February.

J. OTHER ITEMS

1. Cooperative Programs

Since solarizing their lighthouse in the early '90s, the US Coast Guard has gradually been reducing its activities on Southeast Farallon Island. They stopped delivering fuel and water in 1997. The USCG still provides helicopter support for Refuge and other government employees during the non-seabird nesting season (August 15-March 15), when landings are allowed. In September, CG contractors removed the hazardous North Landing Boom, considered Phase I of the CG Cleanup. USCG Environmental Protection Specialist and Refuge Manager Joelle Buffa identified diesel piping, tanks and other items to be removed in Phase II, which is planned for Fall 2003.

The Farallon Patrol is a volunteer group of about 20-30 sailboat and motorboat owners who take turns making twice monthly runs out to the Refuge. Since 1969 they have donated their time, boats, and fuel to transport personnel and supplies.

2. Items of Interest

Lt Gov Cruz Bustamante, Bill Sydeman, Steve Moore, Dr. Robert Curry in Chinook helicopter

National Guard Helo on SEFI helo pad while VIPs tour island Feb 11, 2002

On February 11, the Lieutenant Governor of California, Cruz Bustamonte, and 12 other guests visited the Farallon NWR for a 2-1/2 hour tour. LG Bustamonte chairs the State Lands Commission and sits on the Coastal Commission, and is therefore involved in marine conservation issues. PRBO Board Member Burt McChesney, who is the LG's Chief of Staff, spearheaded the visit. Other guests included CNO Manager Steve Thompson, PRBO staff, board members and CEOs of environmental groups and marine/environmental charitable foundations, and the California Air National Guard.

L to R: Clyde Morris & Joelle Buffa (SFBNW RC) Peter Pyle (PRBO), Mike Parker (SFBNW RC), Joel Miller (CNO), Mike Poole (BLM), Steve Thompson (CNO), Gregg Elliott (PRBO) November 26, 2002

The Refuge hosted another group of VIPs in November from the CNO, PRBO and Tetratech, who via the CA Dept. of Fish and Game patrol boat Bluefin.The purpose of the tour was to review management and protection issue shared by the agencies and conduct a general station review.

During a 5-month operation this summer/fall, clean-up crews removed 85,000 gallons of oil from the sunken ship SS Jacob Luckenbach in a contracted effort organized by the US Coast Guard and other trustee agencies. The 468-foot freighter sank on July 14, 1953 when it collided in heavy fog with a cargo ship. The Lukenbach had been seeping fuel oil from its old tanks for at least a decade, and was finally identified in February 2002 as the culprit of "mystery spills" that have oiled thousands of seabirds along the coast and the Farallon Islands. The wreckage is located southeast of the Farallon Islands in 175 feet of water. Most of the work, which involved pumping the oil out of the sunken tanks using steam and sealing the leak, was done by divers. A couple of small discharges occurred during clean-up operations, and 30,000 gallons were left in the wreckage's tanks that are buried under the sediment.

The Refuge Manager assisted the Luckenbach Incident Command Team in identifying resources at risk, and in developing a contingency plan and wildlife collection protocols for the Farallon Islands.

3. Credits

This narrative was written by Joelle Buffa.

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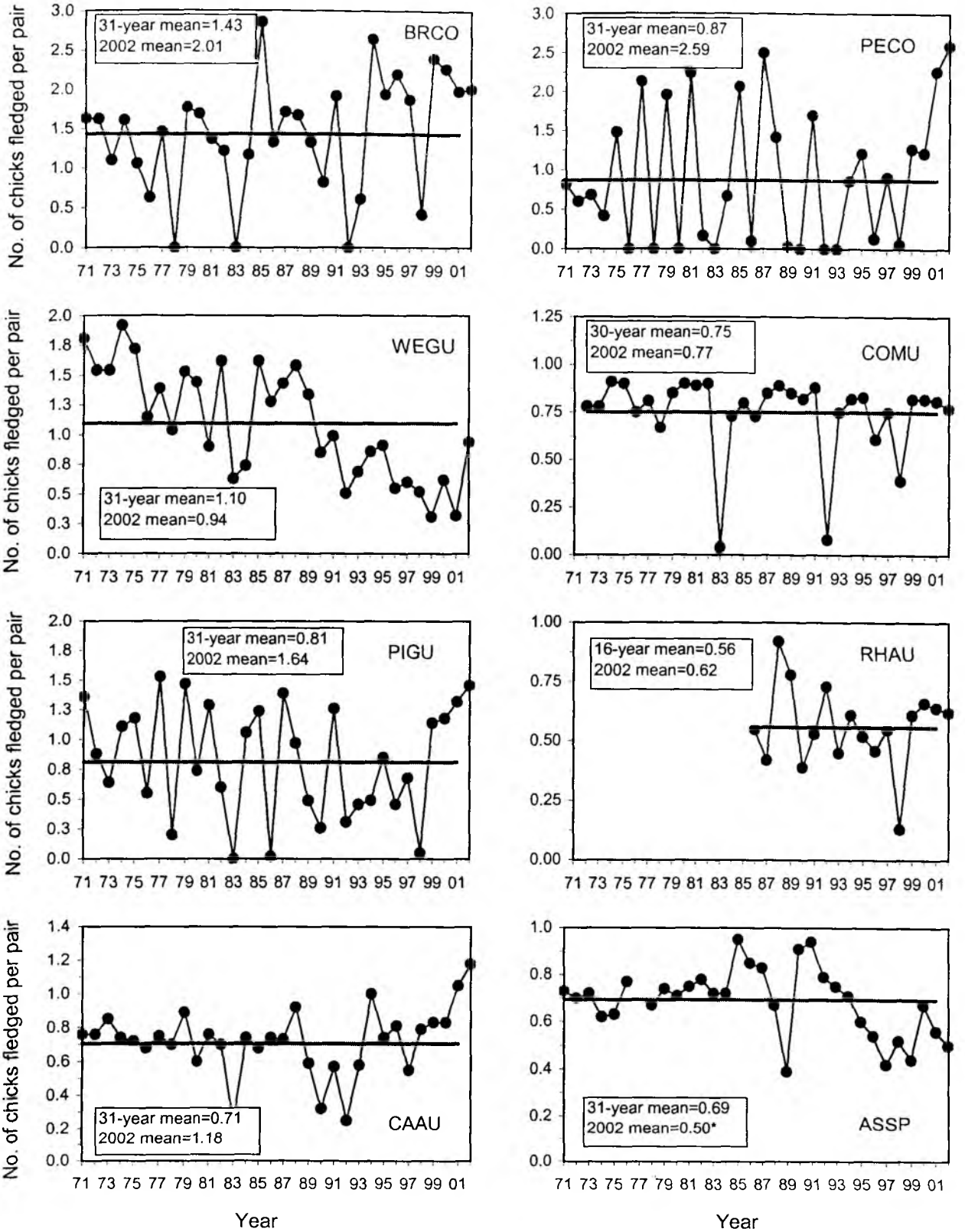
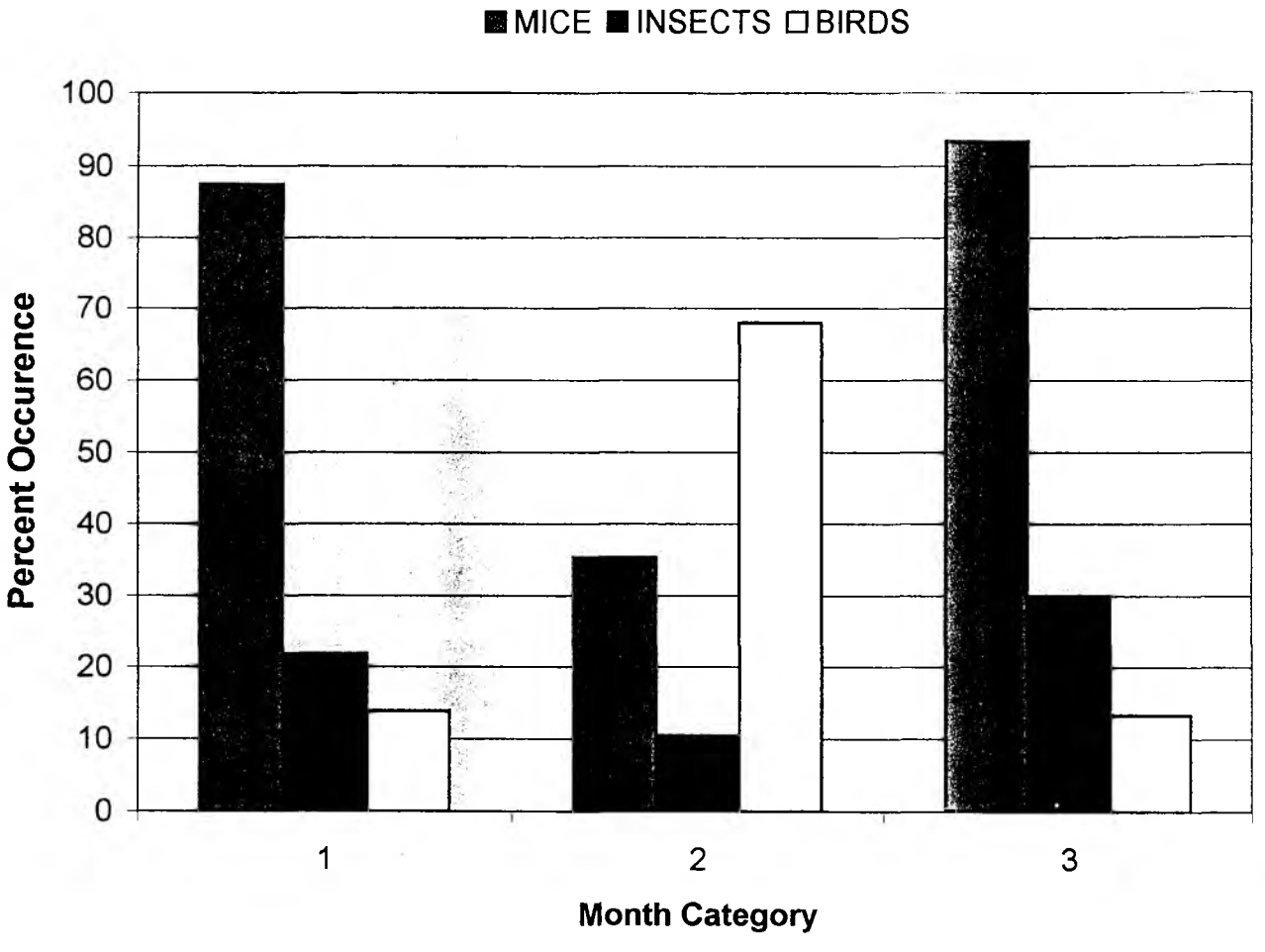


* Estimate only includes those chicks that fledged by mid November.

Fig. 1 . Productivity of 8 species of seabirds on Southeast Farallon Island, 1971-2002. Productivity is measured as number of chicks fledged per breeding pair (includes first attempts, relays and second broods). The bold horizontal line indicates mean productivity from all attempts between 1971 and 2001. Please note the different scales on the y-axis.

Figure 2. Pellet composition by time of year. (1 = Jan - Mar, 2 = Apr - Jul, 3 = Aug -Dec).



MARIN ISLANDS NATIONAL WILDLIFE REFUGE
AND
STATE ECOLOGICAL PRESERVE

Marin County

ANNUAL NARRATIVE REPORT

Calendar Year 2002

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

REVIEWS AND APPROVALS

MARIN ISLAND NATIONAL WILDLIFE REFUGE
AND
STATE ECOLGICAL PRESERVE

Marin County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2002

Christy Smith
Refuge Manager

4/26/04
Date

Margaret J. Kolar
Refuge Complex Project Leader

5/7/04
Date

11. Water Rights	NTR
12. Wilderness and Special Areas	NTR
13. WPA Easement Monitoring	NTR
G. WILDLIFE	8
1. Wildlife Diversity	8
2. Endangered and/or Threatened Species	NTR
3. Waterfowl	9
4. Marsh and Water Birds	9
5. Shorebirds, Gulls, Terns, and Allied Species	11
6. Raptors	11
7. Other Migratory Birds	11
8. Game Mammals	NTR
9. Marine Mammals	11
10. Other Resident Wildlife	12
11. Fisheries Resources	12
12. Wildlife Propagation and Stocking	NTR
13. Surplus Animal Disposal	NTR
14. Scientific Collections	NTR
15. Animal Control	NTR
16. Marking and Banding	NTR
17. Disease Prevention and Control	NTR
H. PUBLIC USE	
1. General	NTR
2. Outdoor Classrooms - Students	NTR
3. Outdoor Classrooms - Teachers	NTR
4. Interpretive Foot Trails	NTR
5. Interpretive Tour Routes	NTR
6. Interpretive Exhibits/Demonstrations	NTR
7. Other Interpretive Programs	NTR
8. Hunting	NTR
9. Fishing	NTR
10. Trapping	NTR
11. Wildlife Observation	NTR
12. Other Wildlife Oriented Recreation	NTR
13. Camping	NTR
14. Picnicking	NTR
15. Off-Road Vehicles	NTR
16. Other Non-Wildlife Oriented Recreation	NTR
17. Law Enforcement	NTR
18. Cooperating Associations	NTR
19. Concessions	NTR

I. EQUIPMENT AND FACILITIES

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

J. OTHER ITEMS

1. Cooperative Programs	NTR
2. Items of Interest	NTR
3. Credits	

K. FEEDBACK

INTRODUCTION

The Marin Islands National Wildlife Refuge (NWR) and State of California Ecological Reserve (SER) is one of seven National Wildlife Refuges in the San Francisco Bay NWR Complex. The San Francisco Bay NWR Complex manages natural resources (fish, wildlife, plants) in the largely urban setting of San Francisco, Oakland, San Jose, Fremont and Vallejo where nearly 7 million people live. The Marin Islands NWR is located east of San Rafael in Marin County in the western portion of San Pablo Bay.

Marin Islands NWR was established as the 479th NWR in April 1992. This NWR is managed as a joint national wildlife refuge and State of California ecological reserve. The California Department of Fish and Game (CDFG) own the West Marin Island (2.8 acres) and the western portion (approx. 1 acre) of East Marin Island (10.3 acres). Another 326 acres of tidelands are leased by FWS from the California State Lands Commission. The FWS provides oversight, management and implements conservation measures for the two islands and adjacent tidelands. The CDFG and FWS operate under a Memorandum of Understanding for management of Napa and Sonoma County north San Pablo Bay wetlands including the Marin Islands NWR/SER.

East Marin Island, approximately 10.3 acres, served as the vacation home for the Crowley Maritime family. As such, two houses and support buildings are located on the island. Fruit trees, eucalyptus and other introduced plants are numerous. Very steep, rocky banks make access to the Island treacherous; however, stairs and walkways are available on the north and south sides of the island. The Island rises approximately 82 feet above sea level.

West Marin Island, approximately 2.8 acres, supports the largest heron and egret rookery in the San Francisco Bay area. It rises approximately 85 feet above sea level and is granite-based with steep rocky banks and rolling terrain. The island is vegetated with native grasses and small trees that provide nesting sites.

Approximately 350 acres of tidelands surround the islands. They are composed of young bay mud that is under constant motion formed by the ebb and flow of the tides. During extremely low tides, the tidelands become exposed mudflats, but may be covered with four to six feet of water at high tides.

A. HIGHLIGHTS

- Continued monitoring of the heron rookery on West Marin Island by Audubon Canyon Ranch researcher John Kelly.

B. CLIMATIC CONDITIONS

San Francisco Bay falls within the humid temperate domain as defined by Robert Bailey (1995). Specifically, the abiotic and biotic factors located in this area combine to produce an ecoregion

within the Mediterranean Division known as the California Coastal Chaparral Forest and Shrub Province. The climate for this province is characterized by hot dry summers and rainy, mild winters. The wet winter season generally runs from November through April with dry seasons throughout the remainder of the year. Annual temperatures range from 50-65° F. Annual precipitation may range from 10-60 inches with an annual average of 14-35 inches.

C. LAND ACQUISITION

1. Fee Title - NTR

2. Easements - NTR

3. Other - NTR

D. PLANNING

1. Master Plan - NTR

2. Management Plan - NTR

3. Public Participation – NTR

4. Compliance with Environmental Mandates – NTR

5. Research and Investigations - NTR

E. ADMINISTRATION

1. Personnel - This Refuge is not staffed. Management is conducted by staff at San Pablo Bay NWR on Mare Island in Vallejo, CA.

2. Youth Programs - NTR

3. Other Manpower Programs - Officers of the San Rafael Police Department check the Refuge for trespassers during their boat cruises.

4. Volunteer Programs - NTR

5. Funding - NTR

6. Safety - NTR

7. Technical Assistance - NTR

8. Other Items - NTR

F. HABITAT MANAGEMENT

1. General

The natural vegetation of the Marin Islands consists of mixed evergreen forest, coastal prairie, coastal salt marsh, and northern coastal shrub. The vegetation and flora of each island is different. Sixty-four species of native vascular plants are known to inhabit the Islands. Of these, 26 are found on both islands, 36 only on East Marin and 2 are found only on West Marin.

2. Wetlands

A tidally influence lagoon is located on the south side of East Marin Island. This stagnant brackish pond is located at the base of a 75' cliff and receives tidal waters during high tides when wind action allows for overtopping of bay waters to enter this lagoon. Several Canary Island Palms similar to those located on Mare Island are located at the high, high tide line separating the lagoon from the bay.

3. Forests

The closed canopy on East Marin Island is dominated by Monterrey pine, Eucalyptus spp., and Coast live oak. Other exotic herbaceous species include an abundance of fennel, scotch broom and vinca.

The native forest once consisted of coast live oak (Quercus agrifolia), California buckeye (Aesculus californica) and California bay (Umbellularia californica). The understory consisted of poison oak (Toxicodendron diversilobum), snowberry (Symphoricarpos albus var. laevigatus), and blue elderberry (Sambucus mexicana). Several ferns made up the herbaceous understory of the forest community on the northern side. Northern coastal shrub was well developed on the tops and faces of the cliffs along the western, southern and eastern portions of the Island.

The forest on West Marin Island is sparse compared to East Marin Island. Coast live oak and toyon (Heteromeles arbutifolia) occur on the western side in a shrubby form interspersed with shrubs of wood rose and introduced annual grasses. The eastern portion is dominated by larger individuals of coast live oak, toyon and blue elderberry (Sambucus mexicana). The central and northern slopes have the best developed forest dominated by California buckeye with some coast live oaks interspersed. Northern coastal shrub on the southern and eastern margins are dominated by California sagebrush (Artemisia californica), live-forever (Dudleya cymosa) and wild buckwheat (Erigonum nudum). On the western and northern margins, northern coastal shrub elements include coyote brush (Baccharis pilularis) and seaside woolly sunflower (Eriophyllum staechadifolum). Coastal salt marsh plants occur sporadically at the waterline.

4. Croplands - NTR

5. Grasslands - NTR

6. Other Habitats

The Islands are surrounded by over 300 acres of submerged wetlands. On the south shore, rocky substrate leads out to the deeper water boat channel. On the north side, sandbars and mudflats provide shallow water habitat.

7. Grazing - NTR

8. Haying - NTR

9. Fire Management - NTR

10. Pest Control - NTR

11. Water Rights - NTR

12. Wilderness and Special Areas - NTR

13. WPA Easement Monitoring - NTR

G. WILDLIFE

1. Wildlife Diversity

Wildlife and plant diversity of the Marin Islands NWR has been documented to varying levels of detail by Refuge staff and various research organizations over the last 10 years. Most efforts have focused on plant and bird assemblages. Results from surveys show the Islands support a diverse array of native plant and avian species. The most notable biological feature of the Refuge is the continued presence of a heron and egret rookery on West Marin Island. Terrestrial mammals have not been detected since establishment as a wildlife Refuge in 1992. Marin mammals known to occur include harbor seals. Bats have not been observed using the Refuge but surveys have not been conducted. The Islands support a wide array of native California flora. Plant communities that have been described on the Islands include mixed evergreen forest, coastal prairie, coastal salt marsh, and northern coastal scrub. Invasive plant species continue to pose a threat to remaining native plant populations.

2. Endangered and/or Threatened Species – NTR

3. Waterfowl

The tidal and sub tidal environments surrounding the islands support a wide array of waterfowl species, especially during migratory and winter periods. Diving waterfowl are most common during winter and migratory periods. Divers commonly observed include surf scoter, scaup, canvasback, western grebe, ruddy duck, and bufflehead. Other less common but recorded species during winter and migratory periods include common loon, western grebe, Clark's grebe, horned grebe, merganser, common goldeneye, and mallard. Waterfowl species known to occur during summer include Canada goose, mallard, and scaup. Canada geese nest on East Marin Island. Because scaup breed in more northern latitudes, individuals present during summer are considered non-breeding for the year.

4. Marsh and Water Birds

The most notable feature of the Marin Islands NWR is the heron and egret rookery on West Marin Island. The rookery is one of the largest in the San Francisco Estuary. Although herons and egrets have been recorded nesting on East Marin Island in low numbers in the past, no active nests have been recorded since 1979. Herons and egrets use East Marin Islands to collect nest material. Audubon Canyon Ranch, a non-profit resource group, has been monitoring the rookery since 1979. Nesting species include the great egret, snowy egret, great blue heron, and black-crowned night heron. Nests of these species are monitored during repeated visits each year, from viewing positions on east Marin Island and by boat. These data are used as part of a regional study of heron and egret colonies in the northern San Francisco Bay area. Number of great egret nests has ranged from 58 (1979) to 190 (1983). In 2002, 121 great egret active nests were observed. During most of the 1990's, the number of great egret nests ranged from 100 to 189. Number of snowy egret nests has ranged from 8 (1994) to 500 (1982). Despite a low of 8 active nests in 1994, snowy egret nests have been increasing. In 2002, 204 egret nests were recorded. Number of black-crowned night heron active nests have ranged from 18 (1995) to 109 (1981). In 2002, 64 active black-crowned night heron nests were observed. Great blue heron's began

nesting on West Marin Island in 1990 and peak numbers were observed in 2001. Number of great blue heron nests has ranged from 0 (1979-1989) to 9 (2000). In 2002, 7 active great blue heron nests were observed.

A pair of common ravens nest on East Marin Island and feed on the rookery during the breeding season. The ravens prey on eggs of herons and egrets, primarily great egrets. The ravens have now expanded their prey base and feed on snowy egret adults. Remains of 15 adult snowy egrets were found in 2002. Other recorded nest predators include western gulls (also nest on West Marin Island) and possibly great horned owls. Despite the continued predation by the raven pair, the colony has remained stable.

Other waterbirds known to use the Refuge include brown pelican, white pelican, and double-crested cormorants.

Rookery on West Marin Island: 2002.

Photo taken by James Martin

5. Shorebirds, Gulls, Terns, and Allied Species

Shorebirds commonly occur along the shoreline of the two islands and use the exposed mudflats during low tide. Shorebird-specific surveys have not been conducted although several species have been recorded during the course of other surveys. Species observed include black-oystercatcher, western gull, Caspian tern, Forester's tern, and black-necked stilt. Black oystercatchers and western gulls nest on West Marin Island. It is likely that many more shorebird species use the exposed mudflats of the Refuge during low tides.

6. Raptors

Raptors commonly observed in the vicinity of the Marin Islands NWR include turkey vulture, red-tailed hawk, and osprey. These species were observed in 2002. Other less common species observed in the past include American kestrel, peregrine falcon, and white-tailed kite. Pellets of great horned owls were observed on East Marin Island in 2002. Osprey forage in the surrounding tidelands and have been observed with prey (fish) on East Marin Island.

7. Other Migratory Birds

Several other passerine species have been recorded on Marin Islands (primarily East Marin island), many of which are migratory. These include Anna's hummingbird, Allen's hummingbird, mourning dove, scrub jay, American robin, Bewick's wren, California towhee, spotted towhee, song sparrow, dark-eyed junco, house finch, American goldfinch, pine sisken, European starling, barn swallow, white-throated swift, and belted kingfisher.

8. Game Mammals – NTR

9. Marine Mammals

Harbor seals use the tidelands of Marin Islands as a haul-out site. Refuge staff recorded observations of harbor seals but volunteers kayaking around the islands make frequent observations. No other marine mammals have been recorded in the vicinity of Marin islands.

10. Other Resident Wildlife

During summer 2002, Refuge staff surveyed East Marin Island for small mammals. Six trap areas were chosen to represent the variety of environments that exist on the island. Ten traps were placed within each environment for a total of 60 traps. Traps were run for three consecutive nights. No small mammals were captured.

In 2002, Refuge staff observed the western fence lizard on the east slope of East Marin Island. This species has not been documented on the Islands in the past.

11. Fisheries Resources

Fisheries resources were not surveyed in 2002 not have they been surveyed in the past at Marin islands NWR. The tidal waters surrounding the islands are likely used by a number of species including steelhead salmon and winter-run Chinook salmon.

12. Wildlife Propagation and Stocking: NTR
13. Surplus Animal Disposal: NTR
14. Scientific Collections: NTR
15. Animal Control: NTR
16. Marking and Banding: NTR
17. Disease Prevention and Control: NTR

H. PUBLIC USE – NTR

SAN PABLO BAY NATIONAL WILDLIFE REFUGE

Napa, Solano and Sonoma Counties, California

ANNUAL NARRATIVE REPORT

Calendar Year 2002

U.S. Department of Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

SAN PABLO BAY NATIONAL WILDLIFE REFUGE

Napa, Sonoma and Solano Counties, California

ANNUAL NARRATIVE REPORT

Calendar Year 2002

Christy Smith
Refuge Manager

4/26/04
Date

Margaret J. Kolar
Refuge Complex Project Leader

5/7/04
Date

TABLE OF CONTENTS

INTRODUCTION

The San Francisco Bay area is one of 34 Waterfowl Habitat Areas of Major Concern identified in the North American Waterfowl Management Plan and is designated a Hemispheric Site by the Western Hemispheric Shorebird Reserve Network. San Pablo Bay provides important habitat for migrating and over wintering waterfowl. In addition, the intertidal mudflats and seasonal wetlands of San Pablo Bay help support the almost one million shorebirds that winter and migrate through the San Francisco Bay area.

Since the 1900s, almost 95% of San Pablo Bay's tidal marshes have been cut off from the bay by levees or they have been filled. In recognition of the need to protect and restore this important habitat, San Pablo Bay National Wildlife Refuge was established with its first land purchase in 1974 for the benefit of migratory birds. Additional properties were later acquired for their particular value for endangered and threatened species. The Refuge consists of approximately 13,190 acres of open bay waters, tidal salt marsh, seasonal wetlands and muted tidal marsh. Management of the Refuge emphasizes the restoration of altered baylands to wildlife habitat. In 1995, the approved boundary expanded to 21,104 acres. Visitor facilities are extremely limited, but an environmental education and interpretive center is proposed for future development.

Refuge Goals

(1) To protect migratory bird populations, and to restore and enhance their habitats.
(2) To protect and enhance populations of endangered, threatened, and rare species in the San Francisco Bay area, and to promote their recovery by restoring and enhancing their habitats.
(3) To protect, restore and enhance habitat for a diversity of fish and wildlife species native to the San Francisco Bay area.
(4) To establish and provide opportunities for wildlife-oriented education and recreation within the highly urbanized San Francisco Bay area.

A. HIGHLIGHTS

Progress continues to be made toward the eventual renovation of Building 505 to become the San Pablo Bay NWR offices and visitor center. Lead contaminated soils were removed in November and the wood pilings supporting the building were tested and proved to be in good condition.

A preliminary public scoping meeting was held to get input on the restoration of Cullinan Ranch with only 4 people in attendance.

Wildlife Biologist, Giselle Downard, former U.S. Geological Survey, San Francisco Bay Estuary Field Station wetland restoration biologist, joined the San Pablo Bay NWR staff in October 2001 and proved to be a valuable asset through 2002. She filled the position of Refuge Manager in an outstanding manner for 6 months when Bryan Winton transferred to Lacassine NWR in Louisiana. Jim Griffin, Maintenance Worker from the SF Bay Complex became a permanent employee at San Pablo in September 2002. Jim is a native of Napa and was pleased to reduce his commute to and

from work each day by 100 miles.

San Pablo Bay National Wildlife Refuge made good progress in 2002 with land acquisition planning (Mare Island, Skaggs Island, and Guadalcanal Village), wetland restoration (Tubbs Island, Cullinan Ranch, conceptual planning of Mare Island dredge ponds, and public use management (signs/kiosks) resulted in higher visibility and improved awareness for the refuge. Jim Millholland, Vallejo resident made many significant contributions to the refuge and brought smiles to staff faces with his enthusiasm and humor. Jim contributed over 500 hours of volunteer time again in 2002, although weekend and at-home refuge-related work often went undocumented, the contribution was viewed as a conservative estimate. Continued co-location with the San Pablo Bay National Wildlife Refuge included Peter Baye and Ina Pisani from Sacramento Ecological Services Field Office (satellite office), Rod King, Migratory Bird Management Program Biologist, and U.S. Geological Survey, San Francisco Bay Estuary Field Station Leader and Research Wildlife Biologist, John Takekawa, Susan Wainwright-De La Cruz, and term staff (including Dan Battaglia, Danika Tsao, Corey Tarwater, Isa Woo, Scott Demers, and Darca Morgan). Due to budget constraints, co-location with the Ecological Services offices was discontinued and those employees returned to the Sacramento office. SCA Education Interns included Stephanie Miller and Jillian Raymond. Sarah Laugtug, Vallejo resident, worked as a summer intern administering both the education program and preliminary research investigation.

B. CLIMATIC CONDITIONS

PETALUMA FIRE STN 3, CALIFORNIA (046826)

Period of Record : 7/ 2/1948 to 7/31/2003

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	56.8	61.6	64.2	68.2	72.8	78.4	82.2	82.5	82.0	76.2	65.6	57.2	70.6
Average Min. Temperature (F)	38.0	40.4	41.5	43.0	46.5	50.3	51.7	51.9	51.2	47.3	42.0	38.1	45.2
Average Total Precipitation (in.)	5.57	4.50	3.29	1.58	0.53	0.18	0.03	0.08	0.24	1.31	3.41	4.42	25.13

C. LAND ACQUISITION

1. Fee Title (NTR)

2. Easements (NTR)

3. Other (NTR)

D. PLANNING

1. Master Plan (NTR)

2. Management Plan

Tidal marsh restoration planning continued for the Cullinan Ranch Unit this year. A preliminary public scoping meeting was held to get input on the restoration of Cullinan Ranch with only 4 people in attendance.

3. Public Participation

Four people participated in the public scoping meeting for the Cullinan Ranch Tidal Restoration preliminary scoping meeting on Mare Island Elementary School.

4. Compliance with Environmental Mandates (NTR)

5. Research and Investigations

Ongoing research continued in 2002 with U.S. Geological Survey, San Francisco Bay Estuary Field Station personnel led by Dr. John Takekawa. Research projects included baseline monitoring of the Tolay Creek Unit, Cullinan Ranch, and Guadalcanal Village Units (Calfed). Canvasback and Scaup telemetry studies to identify contaminant sources were continued. Salt ponds studies included mistnetting dowitchers to identify use patterns and distribution by shorebirds. The Field Station focused on telemetry and salt pond ecology studies, although efforts were made to increase knowledge in restoration ecology, particularly as it applies to tidal marshes.

E. ADMINISTRATION

1. Personnel

Bryan Winton, Refuge Manager since September 1999, has 14 years of Federal Government employment experience. Bryan has served in the U.S. Marine Corps, and worked in research with the National Marine Fisheries Service, National Park Service, and U.S. Geological Survey, Oklahoma Cooperative Fish & Wildlife Research Unit. Bryan has worked with numerous endangered species including Pacific green sea turtles, Hawaiian monk seals, Northern spotted owls, Interior least terns, and threatened Snowy plovers. Previous refuge experiences have included work assignments at Salt Plain National Wildlife Refuge in north-central Oklahoma, and Lower Rio Grande Valley and Santa Ana National Wildlife Refuges in south Texas. Brian transferred to Lacassine National Wildlife Refuge in July 2002. His position was temporarily filled by Refuge

Biologist Giselle Downard.

Giselle Downard, Wildlife Biologist and San Rafael resident, has extensive wildlife research experience, particularly in the Bay Area. Small mammal handling, including the salt marsh harvest mouse, helped confirm Giselle's eligibility as the Refuge Biologist in 2001. Giselle filled in as Refuge Manager through the end of 2002. She displayed a terrific ability to work with the public, researchers and contractors associated with the Refuge and her efforts were noted by her supervisors.

James Griffin, Maintenance Worker and Napa resident joined the refuge in September 2002. Jim was a former Mare Island Shipyard worker who was later employed by the Service at the San Francisco Bay NWR Complex headquarters at Don Edwards NWR when the shipyard closed. Jim reduced his daily commute by 100 miles with his transfer from Don Edwards NWR to San Pablo Bay NWR.

Fran McTamaney, Environmental Education Coordinator, has worked at the San Francisco Bay NWR Complex for 17 years. Fran is largely responsible for and has seen the education program expand considerably in the North Bay in recent years. Fran served as liaison and refuge contact for the Flyway Festival (7th Annual), working closely with former volunteer, Myrna Hayes, co-founder of the festival. Fran's enthusiasm, expertise, energy, and drive has resulted in widespread understanding and appreciation of north bay wetlands for youth ages K-6, many of which have experienced the "wetland walks" on Mare Island.

(L to R) Refuge Chief Dan Ashe, SF Bay Complex Project Leader Marge Kolar, Refuge Supervisor Dave Paullin & Refuge Manager Bryan Winton

Refuge Biologist, Giselle Downard

Jim Griffin, Maintenance Worker

Fran McTamaney, Environmental Education Coordinator

2. Youth Programs (NTR)

3. Other Manpower Programs (NTR)

4. Volunteer Programs

The San Pablo Bay National Wildlife Refuge is pleased to have long-time refuge supporters included in its volunteer program. Robin Leong, Jerry Karr, Anthony Battista, Myrna Hayes, and Fran Demgen, Vallejo residents have been affiliated with the refuge and/or Flyway Festival since the late 1980's. The most significant individual assisting with on the ground refuge work was our newest volunteer, Jim Millholland, also from Vallejo. Jim Millholland donated hundreds of hours in 2002 toward routine grounds maintenance, environmental education program assistance (carpentry and art work), and other mission-critical activities. Many weekend and at-home hours were donated to benefit refuge-related projects. Another new volunteer, Tish Adams, an East Bay resident, assisted Acting Refuge Manager Giselle Downard with refuge projects including trail predator monitoring, research assistance, file organization, and support with the Marin Islands National Wildlife Refuge issues.

Jim Millholland, Maintenance Volunteer

Tish Adams, Biology Volunteer

5. Funding

The San Pablo Bay National Wildlife Refuge is one of 7 refuges in the San Francisco Bay NWR Complex. Funding allocations are based on funded Refuge Management Information System (RMIS) projects (i.e., MMS, RONS), and funds made available from natural resource damages sources (i.e., floods, oil spills, etc.).

Special funds are the key source for the Refuge to continue to improve on large-scale habitat restoration projects. Non-profit supporters, local advocates, and congressional supporters have been the key ingredients to gain necessary additional funding to make progress.

6. Safety (NTR)

7. Technical Assistance

The San Pablo Bay National Wildlife Refuge depends upon technical expertise from several partners to safeguard natural resources on the refuge. Duck's Unlimited, Inc. has been a cooperative partner in tidal wetland restoration projects since the mid-1990's. Point Reyes Bird Observatory, several Universities, and the U.S. Geological Survey, San Francisco Bay Estuary Field Station are key ingredients leading to successful biological resource monitoring on the refuge. Most of the technical expertise with regard to aerial photography has been supplied by Chuck Morton, Supervisor with Caltrans for North Bay traffic projects.

Time and attendance, budget approvals and processing, funding updates/account summaries, vehicle receipt management, and GSA purchases are handled by Administrative staff at the San Francisco Bay National Wildlife Refuge Complex. Cindy Lu, Ellen Tong, Sheila Blackman-Baham, Shella, and Ray have provided considerable assistance to the refuge regarding these issues and others. Project Leader Marge Kolar strongly supports the refuge's many needs and challenges.

8. Other Items

Supervisory Staff meetings are held twice monthly to offer opportunity for Supervisors and Program leaders to present accomplishments and discuss challenges with peers. The Supervisory Staff meetings also include discussions on safety, and many of the programs at the Complex. These meetings afford staff an opportunity to comment, critique, and present ideas for improving existing management of these programs.

F. HABITAT MANAGEMENT

7. General

San Pablo Bay National Wildlife Refuge is heavily involved in habitat restoration– tidal wetland habitat restoration. Pickleweed, the native marsh vegetation in the San Francisco Bay area has been reduced to 15% of its former abundance. This vegetation is critical to the long-term survival of the salt marsh harvest mouse and California clapper rail, both endangered species, endemic to the Bay area. Existing and planned wetland restoration projects designed to restore this habitat type for endangered species, with subsequent benefits to migratory waterfowl and shorebirds include the following sites and acreages:

a.	Cullinan Ranch	1,493 acres
b.	Skaggs Island	3,300 acres
c.	Mare Island	~300 acres

2. Wetlands

San Pablo Bay National Wildlife Refuge is a coastal wetland ecosystem. Wetlands include rainfall driven seasonal wetlands, brackish marsh, tidal marsh, managed tidal marsh, and open bay, mudflats, and monotypic coastal marsh. The wetlands on the refuge support a significant percentage of the diving duck population on the Pacific Flyway (Scaup and Canvasbacks), as well as many migratory shorebird species (dunlin, stilts, avocets, dowitchers, godwits, sandpipers, curlews, and other probing waterbirds).

3. Forests (NTR)

4. Crop Lands (NTR)

5. Grasslands (NTR)

6. Other Habitats

The habitats on the San Pablo Bay National Wildlife Refuge include mud flats, open water, seasonal wetlands, muted tidal marshes (former duck club), and fully functional tidal marsh. Former dredge ponds (3) on Mare Island (seasonal wetlands) continue to support pickleweed due to saline groundwater influence. One of the 3 ponds is apparently too high to be influenced by saline groundwater and since it is not open to tidal action but supported by annual winter rainfall, is converting to upland habitat. Upland habitats include other forms of vegetation including grasses and shrubs. Future plans on Mare Island are to convert 2 of the 3 dredge ponds into actively managed shorebird ponds. Tide water will be pumped into the ponds and moved through them to prevent formation of pickleweed and other vegetation to attract shorebirds in a seasonal manner. These ponds will serve to attract shorebirds away from the 7 dredge ponds adjacent to the refuge that are planned for use as active dredge spoil depositories.

7. Grazing (NTR)

8. Haying (NTR)

9. Fire Department (NTR)

10. Pest Control

Solano County Mosquito Abatement District conducts surveillance and control activities for nuisance insects on the Mare Island Unit, Figueras Unit, and strip marsh south of Highway 37. Solano County MAD supervisor is Victor Baracosa. Vic has over 31 years of experience managing mosquito issues on Mare Island.

Marin-Sonoma Mosquito Abatement District conducts surveillance and control activities for nuisance insects on the tidal marsh west of Sonoma Creek to the Petaluma River mouth. In addition, Marin-Sonoma MAD conducts mosquito control at the Lower Tubbs Island and Tolay Creek Units. Chuck Krauss is the supervisor for control activities in this portion of the refuge.

Bryan Winton, Refuge Manager, serves as the San Francisco Bay National Wildlife Refuge Complex laison for mosquito abatement issues. Joy Albertson handles south bay issues and Ivette Loredo handles Monterrey Bay issues. National policy regarding mosquito management on National Wildlife Refuges is in progress to offer standard guidance for managing pesticide application, surveillance strategies, and justifying disturbance, impact, and activities associated with "nuisance" versus "confirmed health and safety risk" issues associated with flying insects.

The relationship between the San Pablo Bay National Wildlife Refuge and Mosquito Abatement Districts is typical and similar to that with most refuges in the Complex. Years of turnover in staff by both the district personnel and refuge management staff has resulted in frustration and repeated confusion on appropriate practices by the districts. Management concerns vary throughout the years and district practices vary from county to county. Overall, districts appear reluctant to avoid use of ARGO wheeled vehicles in sensitive marsh habitats. In addition, maintaining updated Pesticide Use Permits has been challenging.

11. Water Rights (NTR)

12. Wilderness and Special Areas (NTR)

13. WPA Easement Monitoring (NTR)

G. WILDLIFE

1. Wildlife Diversity

San Pablo Bay National Wildlife Refuge (Refuge) supports a diverse set of wildlife and plant species. Mudflats, open bay, tidal channels, and seasonal wetlands provide key feeding, resting, and reproductive habitats for plants and resident and migratory wildlife. The greatest diversity can be observed in waterfowl and shorebird populations. A significant proportion of the Pacific Flyway population of shorebirds and waterfowl use estuarine environments of San Pablo Bay during the year. San Pablo Bay, as part of the San Francisco Estuary, is designated as a site of "hemispheric importance" by the Western Hemisphere Shorebird Reserve Network. This designation recognizes the importance that an area provides for long-term viability of migratory bird populations. The Refuge also supports a number of wildlife and plant species endemic to tidal marsh of this region, including the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and endangered California clapper rail (*Rallus longirostris obsoletus*).

2. Endangered and/or Threatened Species

The Refuge was established, in part, to conserve habitats of endangered species such as the salt marsh harvest mouse (SMHM). The SMHM is an endemic rodent of tidal marsh environments of the San Francisco Estuary. A major component of SMHM habitat is pickleweed (*Salicornia spp.*), one of the dominant plant species found in tidal marshes of the region. The SMHM is well suited to its environment and is physiologically and behaviorally able to tolerate saline water and tidal fluctuations. The SMHM is believed to feed primarily on seeds and other plant material. It is estimated that tidal marshes of the Refuge support the largest remaining populations of SMHM in the San Francisco Estuary. California clapper rails (CLRA), also Federally listed as endangered, are typically found in the lower marsh zones the intertidal zone and sloughs of brackish marshes dominated by pickleweed, Pacific cordgrass (*Spartina foliosa*), gumplant (*Grindelia spp.*), salt grass (*Distichlis spicata*) jaumea (*Jaumea carnosa*) and adjacent upland refugia. The CLRA typically feeds on benthic invertebrates, but its diet is wide ranging, and includes seeds, and occasionally small mammals such as the SMHM. It is estimated that the overall population of CLRA's may be at its lowest population level, approximately 500 pairs, since the late 1980's and early 1990's (USFWS 2003). The continued decline of CLRA populations is attributed to continued loss of tidal marsh habitat, non-native predators such as the red fox and corvids, and the spread of invasive non-native cordgrass species (*Spartina alterniflora* and *Spartina* hybrids).

Threatened Species and Species of Concern that inhabit the Refuge include the California black rail (*Laterallus jamaicensis*), San Pablo song sparrow (*Melospiza melodia*), Suisun shrew (*Sorex ornatus*), and several anadramous fish species including but not limited to the Sacramento splittail (*Pogonichthys macrolepidotus*) and Delta smelt (*Hypomesus transpacificus*).

Surveys for SMHM were conducted at the Tubbs Island and Tolay Creek units of the Refuge during summer 2002. The majority of Tubbs Island Setback was upland fallow field although a small ditch occurs adjacent to San Pablo Bay. During winter storm events, tidewater flows over the levee and into the ditch. This resulted in the establishment of halophytic plants over time and SMHM were observed here although the remainder of the site supported primarily non-native rodent species. Surveys at Tubbs Island were conducted primarily to assess pre-restoration mammal populations. A post-restoration monitoring plan was developed by the Refuge to monitor physical and biological changes through time at the site (Downard 2002). The Table below identifies the variables that are being monitored at Tubbs Island Setback. Similar measures are used to monitor Tolay Creek

Biological and physical parameters measured post-restoration.

Survey	Sample Size	Frequency	Sampling Period
Vegetation	24 plots, 4 transects	Annual	Mid June-Early July
Small Mammals	4 transects	Annual	Mid April-Early May
Birds	Point counts: 4	Quarterly	March, June, September, December
	Complete area	Monthly	Monthly
Fish	Variable: range of environments over time	Annual	September
Water levels	2 loggers	Continuous	Continuous
Sediment	20 pins	Bi-annual	March, September
Erosion	16 pins	3x/yr	August, December, April

Surveys at Tolay Creek were conducted as part of a 10-year post-restoration monitoring effort (Takekawa et. al. 2002). Salt marsh harvest mouse populations at Tolay Creek remained stable in comparison to previous year's data. Areas flooded with water during restoration in 1999 have not yet risen to marsh elevations and so do not support marsh plants or animals. Monitoring data showed that flooded areas of Tolay Creek are now being colonized by the native cordgrass species, a sign of marsh development. It is expected to support SMHM once higher marsh features develop. Other mammal species captured at Tolay Creek included the shrew (*Sorex ornatus*), California vole (*Microtus californicus*), house mice (*Mus musculus*), and deer mice (*Peromyscus maniculatus*). Dominant species were the California vole and SMHM. Non-native species are house mice and deer mice. Summaries of trapping data were reported in the annual Tolay Creek Monitoring Report produced jointly by the Refuge and USGS.

In April 2002 we conducted the first comprehensive survey of CLRA's along the northern border of the Cullinan Ranch unit (N= 32 sample points). Small pockets of cordgrass marsh occur along the perimeter of Cullinan Ranch. No rails were detected although they are known to occur in the vicinity (Skaggs Island). The purpose of surveys was to assess current conditions at Cullinan Ranch (1500 acres) prior to tidal marsh restoration. Cullinan Ranch was diked and drained for agriculture in the late 1800's. Remaining marsh consists of fragmented cordgrass patches along the outboard levees. Once the site is restored, habitat for native estuarine wildlife and plant species will be restored, including habitat for SMHM and CLRA. Clapper rails were incidentally detected on at least 3 occasions at the Lower Tubbs Island unit in 2002, suggesting this species is colonizing and possibly nesting at the site. A report submitted by the Point Reyes National Seashore in 2002 showed that among 31 marsh sites located in San Pablo and Suisun Bays, Lower Tubbs Island supported high densities of California black rails (PRBO 2002). Clapper

rails have been detected in the Sonoma Creek region of the refuge.

Over the last year, the Refuge has partnered with the Save the San Francisco Bay Association to encourage community participation in wetland restoration. Volunteers assist with seed collection, weeding, and planting. Volunteer work occurs primarily in the transition zone, the area where the marsh meets upland. This region receives little attention in restoration projects and is the most difficult to restore. The transition zone provides high tide refugia to marsh-associated species including the salt marsh harvest mouse ands rails. Species planted in 2002 include creeping wild rye (*Leymus triticoides*), marsh gumplant (*Grindelia stricta*), western goldenrod (*Euthamia spp.*), bee plant (*Scrophularia spp.*), and alkali heath (*Frankenia salina*).

A survey of invasive cordgrass (*Spartina alterniflora* and *Spartina* hybrid) populations was conducted throughout the Refuge in 2002 by the California Coastal Conservancy, Invasive Spartina Project. Neither the non-native cordgrass nor the hybrid was detected on the Refuge. Populations of the invasive hybrid are known to occur throughout the southern part of the San Francisco Estuary.

On March 8, 2002 the Tubbs Island Setback Restoration began with the breaching of the outboard levee to San Pablo Bay. During the same period a study was initiated by the Refuge to examine the relationship between plant and soil development and colonization by wildlife such as the SMHM. The study involved applying a set of treatments including transplanting pickleweed sod, seeding, and use of vegetated coir mats. Each treatment plot was paired with a control. The transplant treatment consisted of moving patches of pickleweed sod to appropriate elevations within the site prior to the breach. Sod was obtained from the small ditch along the southern border of the site that would be flooded following the breach. Soil conditions were assessed prior to the study. A first report of findings will be produced in 2003.

3. Waterfowl

The Refuge provides roosting, feeding, or nesting habitat for a significant portion of the Pacific Flyway wintering population of diving ducks (e.g., canvasback and scaup). At least 18 waterfowl species regularly occur on the Refuge during migratory and winter periods each year. These species have a long history in the San Francisco Bay and use a variety of environments in the region including seasonal wetlands, tidal marsh, open bay, and salt ponds. Resident waterfowl that breed on the Refuge include gadwall, cinnamon teal, mallard, and Canada goose. Each January, Refuge biologists of the San Francisco Bay Complex participate in the annual Pacific Flyway Waterfowl Surveys. These surveys allow a year-to-year comparison of waterfowl populations within and across sites along the Pacific Flyway. Surveys conducted in 2002 showed the San Francisco Estuary comprised approximately 10% of total waterfowl numbers including 83% of sea ducks (primarily surf scoter) and 50% of diving ducks.

In 2002, the open Bay areas of the Refuge supported primarily scaup, canvasbacks, and scoters.

Marsh lagoons, channels, and seasonal wetland areas were dominated by American wigeon, mallard, shoveler, pintail, green-winged teal, bufflehead, goldeneye, and ruddy duck.

Hundreds of scaup were observed throughout summer 2002 roosting within open waters of Tubbs Island Setback, the newly breached restoration site. The site is an open body of water just off the border of San Pablo Bay and acts as a refuge for non-breeding individuals.

4. Marsh and Water Birds

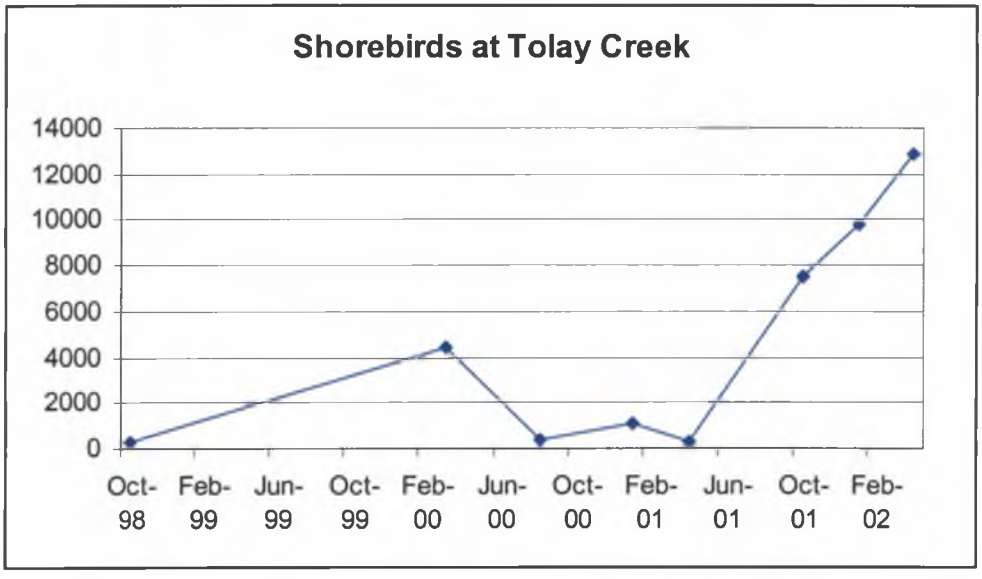
Several bird species other than shorebirds and waterfowl inhabit tidal and seasonal marsh environments at San Pablo Bay NWR. Songbirds that are typically found in tidal marsh include song sparrow, marsh wren, and common yellowthroat. Great blue herons, great egrets, snowy egrets, and black-crowned night herons (BCNH) are commonly observed along the perimeter of tidal lagoons, sloughs, and channels. Herons and egrets roost and forage but are not known to breed on the Refuge. American white pelicans were commonly observed in groups greater than 60 individuals at the Figueras and Lower Tubbs Island units during summer 2002. The pelicans are non-breeding individuals on the Refuge. During winter, greater than 45 black-crowned night herons were observed regularly in the northern lagoon of Lower Tubbs Island. It is unknown whether this site has historically been a wintering location for BCNH's.

In 2002, bird surveys were conducted at Tolay Creek, Cullinan Ranch, Lower Tubbs Island, and Tubbs Island Setback. Bird surveys included playback-call surveys for rails, point counts for songbirds, and complete-area surveys for waterbirds. Surveys were conducted by Refuge staff, U. S. Geological Survey, and Point Reyes Bird Observatory. At Lower Tubbs Island, song sparrows and marsh wrens were the most abundant species encountered during point counts (PRBO 2002). Other common species included common yellowthroats, black rails, and cliff swallows. Two Virginia rails were detected at Lower Tubbs Island in October 2002. At Tolay Creek, song sparrows and marsh wrens were also the most abundant species detected during point counts (USGS 2002).

5. Shorebirds, Gulls, Terns, and Allied Species

Shorebirds represent one of the most diverse groups of wildlife observed on the Refuge. In a recent publication it was stated that "on the conterminous U. S. Pacific coast, the bay holds more total shorebirds than any other wetland in all seasons, and it holds the majority of individuals of the 13 most abundant shorebirds in one or more seasons (Stenzel et. al. (2002). More than one million shorebirds are known to move through the San Francisco Estuary each year. Common species include western and least sandpipers, dowitchers, marbled godwits, dunlin, long-billed curlew, black-bellied plover, American avocet, black-necked stilts, willet, semi-palmated plover, red knot, yellowlegs, sanderling, black turnstone, and red-necked phalarope. The extensive mudflats of the Refuge provide key foraging areas for shorebirds at low tide. During migratory and winter periods, the mudflats are often full of foraging shorebirds as far as the eye can see.

Although bay-wide surveys were not conducted for shorebirds in 2002 (as with waterfowl), several areas were monitored. These sites include Tolay Creek and Tubbs Island. Additional shorebird surveys are conducted in the CDFG salt ponds just north of the Refuge. It is believed that many shorebirds in the area conduct daily movements between the salt ponds and mudflats in response to food sources and the changing tides. In addition to mudflats and salt ponds, newly restored wetlands also provided new foraging and roosting habitats in 2002. A monitoring report for Tolay Creek showed significant increases in use by shorebirds since the breach. A similar pattern of increased shorebird use is also observed at the newly restored Tubbs Island site.



Several gull and tern species are also abundant on the Refuge. Both Caspian and Forster terns forage on the Refuge and breed in adjacent salt ponds managed by the California Department of Fish and Game (CDFG). The endangered California least tern has been observed occasionally during spring and summer feeding in the Tolay Creek area. American avocets and black-necked stilts are confirmed breeders in the San Pablo Bay region. In 2002, fledgling black-necked stilts were observed at Tolay Creek. Avocets breed on levee tops within the State of California Fish & Game salt pond system just north of the Refuge.

6. Raptors

Both resident and migratory raptor species use the Refuge. The highest densities of raptors are observed during the fall and winter months. Red-tailed hawks are one the most abundant species and are considered year-round residents. Other resident species include northern harriers and black-shouldered kites. Additional species observed during 2002 winter and migratory periods include American kestrels, sharp-shinned hawks, red-shouldered hawks, peregrine falcon, golden eagle, Cooper's hawk, ferruginous hawk, rough-legged hawk, merlin, and prairie falcon. Of notable mention was the first observation of a Swainson's hawk on Skaggs Island in January

2002. This was only the 5th Sonoma County record for Swainson's hawk and the first winter record.

7. Other Migratory Birds

San Pablo Bay National Wildlife Refuge is important to a host of other migratory song birds. These species are observed primarily in transition zone plant assemblages bordering tidal marsh throughout the refuge. Meadowlarks, robins, red-shafted flickers, ruby-crowned kinglets, Say's phoebe's, golden-crowned sparrows, white-crowned sparrows, yellow-rumped warblers, and many other passerines use the refuge during spring and fall migrations.

8. Game Mammals

Black-tailed deer are the only game mammal found on the San Pablo Bay National Wildlife Refuge. Their presence is limited mostly to the Sonoma Creek marsh/levees and Tolay Creek area and west. Three individuals utilized the former Tubbs Island Setback site prior to tidal restoration. A single individual has been sighted on numerous occasions occupying levee tops within the Lower Tubbs Island muted marsh. No sightings of black-tailed deer have been made on Mare Island or Cullinan Ranch.

Jackrabbits and Marsh rabbits are numerous to abundant and widespread on Mare Island, Figueras Unit, Cullinan Ranch, Tolay Creek and the Lower Tubbs Island Units.

9. Marine Mammals

Harbor seals, sea otters, and river otters are found on San Pablo Bay National Wildlife Refuge. Historic haul-out sites for harbor seals occurred at the Lower Tubbs Island muted marsh area (a.k.a. Long Point). In recent years, the marsh spits have eroded and harbor seals have no longer been observed utilizing these sites to rest during high tides. Of interest was the sighting of a beaver near the mouth of Tolay Creek in 2002. It is likely that this individual traveled out of its range from the Delta region.

10. Other Resident Wildlife

Pheasants are introduced resident wildlife at the Tolay Creek, Lower Tubbs Island, Cullinan Ranch, and Mare Island Units. Pheasants and Chukars are stocked/released from the Black Point Gun Club west of Tolay Creek and south of Sears Point–less than one mile from the western edge of the refuge. Pheasants on Mare Island successfully made the 9-mile journey through tidal marsh to find suitable habitat (associated w/fennel) on Mare Island.

Pheasant hunting is allowed on the Tolay Creek Unit of the Refuge. However, since the December 1999 tidal wetland restoration there, habitat suitable for pheasant cover has been limited to areas immediately adjacent to the levee road and primarily in habitat located on the Vallejo Sanitation and Flood Control District (VSD) and tenant farmer Norm Yenni's farmfield toe-drains. VSD has expressed opposition to pheasant hunting on their property, the location of most of the remaining suitable habitat. The Refuge will assess whether pheasant hunting will be permitted in future years.

11. Fisheries Resources

Fish surveys were conducted at Tolay Creek and Tubbs Island in 2002. Fourteen species were detected at Tolay Creek and 16 species at Tubbs Island. Important species noted include native species; Arrow goby (*Clevelandia ios*), Pacific herring (*Clupea pallasii*), Pacific staghorn sculpin (*Leptottus armatus*), threespine stickleback (*Gasterosteus aculeatus*) and topsmelt (*Artherinops affinis*). At both sites fish were sampled using a beach seine technique. No special status species were captured although carcasses of sturgeon and salmon species were observed along the banks.

12. Wildlife Propagation and Stocking

The Refuge does not participate in wildlife propagation. However, the Refuge promotes pheasant hunting primarily due to excess birds escaping hunting pressure from Black Point Gun Club, the release point for pen-reared birds.

The Solano County and Marin-Sonoma County Mosquito Abatement Districts have both released mosquito fish (Gambusia spp.) on Refuge lands in the past where impoundments or tidal ponds exist that produce high numbers of mosquito larvae.

13. Surplus Animal Disposal

Pheasants, escaping from Black Point Gun Club, exist in high abundance from November through May. Increased pheasant abundance is counter-balanced by hunting and increased raptor numbers during winter and spring. Raptors feed on the abundant pheasants, reducing predation pressure on other native bird and mammal species.

14. Scientific Collections

Scientific collection of unknown fish species was conducted during fisheries surveys at Tolay Creek and Tubbs Island. Samples are in the process of identification.

15. Animal Control

Predator management is a component of the South Bay refuges, to protect nesting California

clapper rails. Predator management is not a component of North Bay refuges. The U.S. Navy requires the City of Vallejo to conduct 20 hours per week of predator management on Mare Island to reduce skunk, feral cat, dog, raccoon, and opossum numbers to acceptable levels, thereby reducing their impact to threatened and endangered species living in the tidal marshes on the western portion of Mare Island.

16. Marking and Banding

In 2002, San Francisco Bay Estuary Field Station (USGS) initiated a study of surf scoters that winter in the San Francisco Estuary. The goal of the study is to identify feeding locations and migratory movements in relation to disturbance and contaminants. Individuals were fitted with either radio or satellite transmitters and followed throughout the winter and to summer breeding grounds.

17. Disease Prevention and Control (NTR)

2002 Reports:

Downard, G. T. 2002. Tubbs Island Setback Monitoring Plan. United States Fish and Wildlife Service, San Pablo Bay NWR, Vallejo, CA. 28pp.

Spautz, H. 2002. Tubbs Island Bird Survey results. Point Reyes Bird Observatory, Stinson Beach, CA. 10pp.

Spautz, H. and N. Nur. 2002. Distribution and Abundance in Relation to Habitat and Landscape Features and Nest Site Characteristics of California Black Rail *(Laterallus jamaicensis coturniculus)* in the San Francisco Bay Estuary. Point Reyes Bird Observatory, Stinson Beach, CA. 36pp.

Stenzel, L. E., C. M. Hickey, J. E. Kjelmyr, and G. Page. 2002. Abundance and distribution of shorebirds in the San Francisco Bay Area. Western Birds, 33:69-98.

Takekawa, J. Y., M. A. Bias, I. Woo, S. A. Demers, and G. T. Downard. 2002. Restoration research and monitoring in bayland wetlands of the San Francisco Bay Estuary: the Tolay Creek Project, Unpubl. prog. Rep., Vallejo, CA. 74pp.

H. PUBLIC USE

1. General

San Pablo Bay National Wildlife Refuge allows waterfowl and sport fishing in the open bay waters of San Pablo Bay. Upland game bird hunting for pheasants is permitted one month annually (during

regular season) at the Tolay Creek Unit. The Tolay Creek Unit also has a public trail that is suitable for walking or bicycling that offers the public opportunities for wildlife viewing, hiking, photography, and environmental education utilizing Vallejo Sanitation and Flood Control District earthen levee access. The trail starts from the parking lot, 0.6 miles east of Sears Point (South of HW 37), and directs the public south to Lower Tubbs Island and back, a round-trip of 8.2 miles. Environmental education and interpretation are available for school teachers and students on Mare Island. Staff and Volunteer-led wildlife observation and interpretive hikes were offered in 2002 to expand public access opportunities for the public on Mare Island. The Mare Island Unit of the San Pablo Bay National Wildlife Refuge is still owned by U.S. Department of Navy, although early transfer of a significant portion of requested lands was negotiated in early 2002.

2. Outdoor Classrooms- Students

Each year, Fran McTamaney, Environmental Education (EE) Coordinator for the San Francisco Bay NWR Complex and a Student Conservation Association (SCA) rotating intern, design and conduct the EE field trip program at San Pablo Bay National Wildlife Refuge. From mid-September to mid-June, Fran trains and supervises three different, 3 month SCA interns to provide educator-led field trips for Grades K-6 on Mare Island. Fran works one or two days a week at San Pablo Bay National Wildlife Refuge and the other days supervising the EE Programs at the Environmental Education Center in Alviso, California and the Visitor Center in Fremont, California. The students learn about the marsh habitat, migratory birds, and threatened and endangered species. "In the Marsh on Mare Island" was completed in spring 2002.

- Educators brought 883 students on field trips.
- 372 students participated in the Mud Studies Watershed 3rd grade in-class program.

A total number of 1,255 students were served by the environmental education program.

3. Outdoor Classrooms- Teachers

During 2002, thirty-five educators were trained by Fran McTamaney, EE Coordinator for the San Francisco Bay NWR Complex and an SCA intern at four separate 4-hour field trip orientations. Time in 2002 was spent completing the educator guide and developing the in-class program. Thirty-seven educators brought their students on field trips. Ninety-four parents helped the educators conduct the field trips. Fran and the intern advertised the EE Program at local EE fairs and at the quarterly meeting of the Napa-Solano Education Group. These meetings give each EE organization or agency an opportunity to share EE resources to pass on to educators. This year, a watershed model was added to the in-class program.

- 20 Educators participated in the Mud Studies Watershed 60-minute program
- 37 Educators brought students on field trips

A total number of 57 Educators participated in the in-class and field trip programs.

4. Interpretive Foot Trails

Interpretive environmental education programs were available to school groups K-6, thanks to Fran McTamaney, Environmental Education Coordinator for the San Francisco Bay NWR Complex (San Pablo Bay NWR). An expanded program was promoted in 2002. Student Conservation Association (SCA) interns Stephanie Miller and Jillian Raymond both made significant progress with completing the teacher guide, "In the Marsh on Mare Island" utilizing future interpretive foot trails, and excelled in making the environmental program concepts available to the local schools. The main focus was advertising the programs and obtaining grants for busing.

A public use trail is open to the public on Tolay Creek. Interpretative material on the trail is planned for the future. Future interpretive trails are in the planning stages for Mare Island. They will be open to the public when completed.

5. Interpretive Tour Routes (NTR)

6. Interpretive Exhibits / Demonstrations

Building 505, the home of the future "Baylands Discovery Center" for headquarters, environmental education, and exhibits, will be the site of interpretive exhibits/demonstrations when the renovation of the building is completed. Until then, the Refuge does not have an official public interpretive center and relies on the San Francisco Bay NWR Complex headquarters in Fremont to promote our mission and programs, and to distribute information about the San Pablo Bay National Wildlife Refuge.

7. Other Interpretive Programs

Outreach opportunities included EE fairs for Earth Day and Coast Clean-ups. The Flyway Festival is the main outreach vehicle for San Pablo Bay National Wildlife Refuge. Besides the dedicated work of San Pablo staff and volunteers, the Complex headquarters provides the volunteer coordinator and between 15-20 volunteers, complex staff (3 education, 3 public safety, 2 maintenance, 1 interpretative, 2 refuge managers) during set-up the day before with tables, chairs, heaters, wiring, plants, display booths, and work at the Friday evening art and wine event and on Saturday to work at the refuge and complex display tables, conduct wetland walks on Mare Island, supervise and work in the children's craft room, work on the raffle table, greet visitors, take sign-ups for walks, drive the shuttle vans for parking, distribute gate passes, and related activities. Weeks before the festival, staff and volunteers work to prepare Building 505 and grounds and help clean the facility.

8. Hunting

San Pablo Bay National Wildlife Refuge is open 7 days a week for waterfowl hunting on the open waters and navigable sloughs during the regular State of California Department of Fish & Game waterfowl season. State hunting season and bag limits apply. Pheasant hunting is available to the general public during the one month regular season at the Tolay Creek Unit. Pheasant abundance at this site is artificial due to pen-reared birds escaping from the nearby Black Point Gun Club.

9. Fishing

San Pablo Bay National Wildlife Refuge is open 7 days a week year-around for sport fishing. Sport fishing is permitted on the open water and navigable sloughs of San Pablo Bay by boat access only. Illegal shoreline fishing occurs at the upper lagoon of the Tolay Creek Unit and upper levee portions of this area due to an abundance of striped bass in the upper lagoon. This activity demonstrates that tidal wetland restoration of Tolay Creek, initiated in December 1998, is producing habitat suitable for bait fish and sport fish. Signs are posted to close fishing from the levees below the Tolay Creek lagoon, which is owned by California Department of Fish & Game, due to trampling impacts to pickleweed vegetation along the waters side of several sections of levee. Trash, campfires, and other activities were taking place out of the sight of game wardens and refuge staff, so the activity was closed for the benefit of threatened and endangered species, migratory birds, and to eliminate potential management conflicts.

Illegal fishing from the west shoreline of Sonoma Creek on the south side of the Highway 37 bridge has taken place for years. The retrofit of this bridge temporarily impacted the parking for fishing from this area, but since completion, has enabled fishing access from both ends and both sides of the bridge, thereby increasing pickleweed marsh and potentially endangered species impacts. Discussions with Caltrans personnel have been initiated in an attempt to reduce access points and to better manage the access and activities at this site. Several trails have been established, excessive garbage and organized debris piles have been arranged, and on several occasions, fishermen have brought pets.

10. Trapping

No predator control trapping is occurring on San Pablo Bay National Wildlife Refuge. This activity should be evaluated since reports indicate California clapper rails decline in the North Bay may be attributed to an increase in naturally occurring and introduced predators.

Small mammal live-trapping has occurred annually at the Tolay Creek Unit to evaluate the population status of the Salt marsh harvest mice and other small mammals.

11. Wildlife Observation

San Pablo Bay National Wildlife Refuge offers wildlife observation from several locations. The Cullinan Ranch Unit is only accessible via automobile while traveling Highway 37, except for the California Department of Fish & Game pullout along the "Can club" levee road that separates the western border of the property from Salt Pond No. 1. Tolay Creek Unit is observable from Highway 37, but also offers 8.2 miles (round-trip) of hiking trails to view wildlife. This site, jointly managed by the refuge and the California State Lands Commission and California State Department of Fish and Game, initiated a 435-acre tidal wetland restoration project in December 1998 to improve site conditions for salt marsh harvest mouse, California clapper rails, and migratory birds. Winter migrations of waterfowl and shorebirds offer extraordinary wildlife viewing opportunities from the south loop of this trail. Waterfowl, gulls, shorebirds, herons, and raptors are nearly always present, and kites, pheasants, red-winged blackbirds, burrowing owls, horned larks, killdeer, tundra swans, Forster's terns, Caspian terns, and cormorants can be seen in spring and summer.

Tolay Creek Unit is a must-see for any North Bay outdoor enthusiast. No pets are allowed at this site to eliminate disturbance to mice, birds, rabbits, and eliminate odors that would influence movements of raccoons, coyotes, foxes, and other mammalian predators, potentially attracted to domestic animal urine or feces.

12. Other Wildlife Oriented Recreation

The Flyway Festival was held from January 19-21, 2002. About 4,000 people attended the Saturday festival. About 290 people attended the adult wetland walks and 90 people attended the family wetland walks for a total of 380 participants on the walks on the trails north of building 505.

Total number of participants on 1/19/02
Slide Show- 90
Intern Family Walk and Intern Bird ID Walk- 90

Total number of participants on 1/20/02
Mare Island Walks, Cullinan Ranch Walks, Intern Wetland Walk, Tolay Creek Walk- 139
BAEER fair was held in January at the Marin Civic Center and 500 educators received information about the Complex refuges. The Annual California Coastal Clean-up took place in September. This involved approximately 30 volunteers who came to the refuge to gather trash and other refuse to deliver it to designated sites throughout the San Francisco Bay. The event is sponsored by the California Coastal Commission.

13. Camping (NTR).

14. Picnicking (NTR)

15. Off-road Vehicles

No off-road vehicles are allowed on San Pablo Bay National Wildlife Refuge except for staff and supervisors engaged in County mosquito abatement activities (surveillance and application). ARGO or 6-wheeled plastic-tracked amphibious vehicles are used to access tidal ponds, marshes with poor circulation, and other sites that have a history of producing mosquitoes. ARGO use is extremely controversial due to their direct impact to endangered species, nesting birds, and aesthetic impacts to pickleweed marsh. ARGO may also provide trails for predators that otherwise would not enter the marsh. A national effort is currently underway to evaluate mosquito abatement activities and standardize permissible activities, approaches, chemicals, and practices by County Mosquito Abatement Districts on National Wildlife Refuges nation-wide.

16. Other Non-Wildlife Oriented Recreation (NTR)

17. Law Enforcement

Law enforcement patrols by the San Francisco Bay National Wildlife Refuge Complex were significantly reduced in 2002. The events of September 11, 2001 and a reduction in available law enforcement staff at the Complex negatively impacted the law enforcement presence and enforcement of public uses for this refuge.

California Department of Fish & Game warden, particularly Hugh Buttrom and Rick Mead, both made monthly patrols at the Tolay Creek Unit, writing citations for fishing without licenses, pheasant hunting out of season, and illegal camping. An outstanding relationship with the state wardens has enabled sufficient patrols for the San Pablo Bay National Wildlife Refuge.

18. Cooperative Associations

The San Francisco Bay Wildlife Society is a 503c non-profit organization that has handled the bookstore, special projects, and various activities for the San Francisco Bay NWR Complex.

19. Concessions (NTR)

I. <u>EQUIPMENT AND FACILITIES</u>

1. New Construction (NTR)

2. Rehabilitation (NTR)

3. Major maintenance

Jim Griffin, Maintenance Worker for the San Francisco Bay National Wildlife Refuge Complex was transferred to the San Pablo Bay National Wildlife Refuge in 2002. Jim maintains equipment, tools, electrical and plumbing, and fabricates, installs gates (pipe and cable gates), signs, and kiosks.

4. Equipment Utilization and Replacement

The refuge maintains a 13' Boston Whaler, a John Deer Tractor w/articulating flail mower and deck mower, a worn backhoe, and new International dump truck.

5. Communications Systems

The San Francisco Bay NWR Complex purchased new Nextel brand phones for the entire Complex staff in 2001. Thanks to Chris Bandy for spearheading this effort, this phone system continued to be invaluable through 2002. The phones dramatically upgrade the communications abilities for the Complex, providing phone and hand-held radio capabilities.

The Internet and e-mail capabilities were disabled from December 6, 2001 until early April 2002. The shutdown was due to Bureau of Indian Affairs trust funds accountability issues that resulted in Department of Interior-wide email/Internet shutdown.

6. Energy Conservation (NTR)

7. Other (NTR)

J. OTHER ITEMS

1. Cooperative Programs

The Student Conservation Association provides interns to support the San Francisco Bay NWR Complex Environmental Education Program including San Pablo Bay National Wildlife Refuge. Fran McTamaney administers the program screening applicants and hiring staff, and supervising the Environmental Education activities.

The California Conservation Corps, located on Mare Island, has assisted with the Flyway Festival and refuge projects for the past few years.

Duck's Unlimited, Incorporated has been under Cooperative Agreement with the San Pablo Bay National Wildlife Refuge since 1997, to assist with tidal marsh wetland restoration projects.

Save the Bay, a 503c non-profit organization, approached the refuge in 2000 to initiate the "Canoes in Sloughs" environmental education program and "Community-based Restoration Program" at the Tolay Creek Unit. Marilyn Latta led the program and contacts with the refuge. Restoration activities have included assistance with the Phase II of the Lower Tubbs Island Levee Setback Project (planting and fabric install), native plantings throughout the Tolay Creek restoration site, and Perennial pepperweed (Lipidium) non-native weed pulling/composting.

Caltrans, the state of California Transportation Department, approached the San Pablo Bay National Wildlife Refuge to draft and secure a cooperative agreement for future addition of the 53-acre Guadalcanal Village Unit tidal wetland restoration project initiated on October 31, 2001. This site was highly engineered to enable marsh restoration within an 8 year period. Upon satisfying mitigation criteria (by 2009), Caltrans has committed to transferring fee title of the property along with $150,000 in funds to be used as a funding source for long-term maintenance (i.e, mowing, fence repair, garbage pickup, weed control, etc.). Thanks go to Chuck Morton, Caltrans Biologist, for making this opportunity available to add lands immediately adjacent to the Cullinan Ranch Unit, north of Mare Island.

2. Items of Interest

Highlights for 2002 include the following:

- Skaggs Island land acquisition pursuits (SFO Airport)
- Mare Island conceptual management planning (dredge pond issues)
- Building 505 "planning and design" delays (lead soil sampling; piling inspection)
- Lower Tubbs Island Levee Setback Project (Phase I and II progress)
- Volunteer Jim Millholland assists with many aspects of refuge maintenance
- Louise Vicencio resigns and Giselle Downard accepts Wildlife Biologist position
- Save the Bay continues re-vegetation planting and weed control at Tolay Creek
- Refuge Manager, Bryan Winton transfers to Louisiana, Giselle Downard is "Acting" Refuge Manager.

3. Credits

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