

DON EDWARDS
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
Fremont, California

ANNUAL NARRATIVE REPORT

Calendar Year 2000


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

REVIEWS AND APPROVALS

DON EDWARDS
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Refuge Manager 12/16/02
Date



Refuge Complex Manager 12/16/02
Date

INTRODUCTION

San Francisco Bay has long been regarded as a Pacific gateway to America. So it is fitting that the San Francisco Bay National Wildlife Refuge Complex plays that same role as a "gateway" to the U.S. Fish and Wildlife Service programs and the 530+ units of the National Wildlife Refuge System.

Included in the San Francisco Bay NWR Complex are seven refuges, stretching from Monterey Bay to the San Francisco Bay Delta. This complex is a unique combination of habitats and wildlife species. The Don Edwards San Francisco Bay NWR in the South Bay has tidal marshes, vernal pools, and salt ponds. At the north end of the Bay is the San Pablo Bay NWR with estuaries and marsh habitat. The Farallon NWR, which lies thirty miles off the coast from the Golden Gate Bridge, is comprised of high rocky islands frequented by a host of seabirds, seals, and sea lions. A quiet upland habitat for the endangered Santa Cruz long-toed salamander can be found at the Ellicott Slough NWR just south of Santa Cruz. The Salinas River NWR just north of Monterey encompasses an area of pristine beach, dunes, and lagoon habitat. Found in the small pockets of native habitat at Antioch Dunes NWR are the endangered Antioch Dunes Evening Primrose, Contra Costa Wallflower and the Lange's Metalmark butterfly. The Marin Islands NWR and State Ecological Reserve in San Rafael Bay just south of San Pablo Bay NWR is the one of the largest wading bird rookeries in North San Francisco Bay.

In 1972, Public Law 92-330 provided for the establishment of San Francisco Bay National Wildlife Refuge for the preservation and protection of critical habitat and associated wildlife, migratory waterfowl and to provide an opportunity for wildlife-oriented recreation and nature study. In 1988, Public Law 100-556 was passed which increased our acquisition authority an additional 20,000 acres. Don Edwards San Francisco Bay National Wildlife Refuge encompasses approximately 25,901 acres in San Mateo, Alameda and Santa Clara counties, California at the southern end of San Francisco Bay. San Francisco Bay is one of the largest estuaries in the nation, approximately 55 miles long and 3 to 12 miles wide.

Under an agreement between the Cargill Salt Division and the Service when the Refuge was established, approximately 12,500 acres remain as active salt evaporation ponds. The remaining habitat consists of salt marshes, upland, tidal mudflats and open water.

This variety of habitat supports a large number of wildlife, including 5 endangered species. The Refuge provides major habitat for the endangered California clapper rail and salt marsh harvest mouse. San Francisco Bay is a key wintering area for diving ducks along the Pacific Flyway. The south bay wetlands support hundreds of thousands of shorebirds along with the largest wading bird rookery located in the bay.

Marine mammals also utilize the open water and sloughs. A major harbor seal haul out site is located in Mowry Slough.

Don Edwards San Francisco Bay National Wildlife Refuge is surrounded by an urban population of 7 million people. In spite of the potential impacts of encroaching development, plans are to complete acquisition of the approved 43,000 acres.

The Refuge is also a place to learn about the Bay environment through exhibits and naturalist programs; to observe and photograph wildlife; to hike, hunt and fish; and to enjoy some precious natural habitats in the heart of a great metropolitan area.

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K. FEEDBACK

A. HIGHLIGHTS

--Cargill announced they would offer 19,000 acres of salt ponds for sale to the government for restoration. (Section C-3)

--Refuge hosted a Thank You event for the 70 people most involved in the protection of Bair Island. (Section D-3)

--Harry Sanders retired after almost 10 years of managing the Native Plant Nursery. Harry was honored as the National Volunteer of the Year (Section E-4)

--The Environmental Education Center boardwalk opening celebration was well received. (Section D-3)

--A public scoping meeting was held for the Bair Island Restoration and Management Plan. (Section D-4)

--A study of bird use of salt ponds was started in preparation for restoration planning in the South Bay. (Section D-5-j)

--A total of approximately 749 hours of staff and volunteer time were totaled during staff involvement with Boy Scouts and Girl Scout programs. (Section E-2.)

--1,376 Volunteers donated approximately 27,369 hours of time to the Service. (Section E-4).

--Western snowy plovers appear to have shifted a large portion of their nesting efforts from the Refuge to the Eden Landing Ecological Reserve. (Section G-2-c)

--Surveys indicate the California clapper rail population trends in several east bay marshes are lower than previous years while west bay marshes appear to be more stable.(Section G-2-d)

--The Refuge environmental education program served 6,931 students and 1,690 teacher/parent leaders during the year. (Section H-1).

--220,351 visitors participated in interpretive activities at the Refuge. (Section H-6)

--An Interagency group was formed to protect marine mammals and nesting seabirds along the Central California Coast (Section H-17).

--The entire siding of the Environmental Education Center was replaced. (Section I-2)

B. CLIMATIC CONDITIONS

In a normal year, the Bay area has a modified Mediterranean climate with warm to hot, dry summers and moist, mild winters. Ninety percent of our rainfall occurs in the late fall and winter months with January being the wettest. Normal annual rainfall amounts vary according to local topography. In the South Bay 16-20 inches is normal while some areas in the North Bay receive more than 45 inches. We experienced slightly above normal rainfall in a non-normal pattern. From January 10 through March 9th, it rained 44 out of 60 days. It rained a record 21 days in February. This 60 day period saw 70% of the seasons rainfall total. It was relatively dry the rest of the year.

C. LAND ACQUISITION

1. Fee Title

No lands were added to the San Francisco Bay National Wildlife Refuge during 2000. However, during the year, Catellus Corporation agreed to purchase and donate to the Refuge the 20-acre Onorato property next to the Refuge's Warm Springs Unit. This was a part of the mitigation required by the California Regional Water Quality Control Board for Catellus' Pacific Commons Development in South Fremont.

During the year, CALTRANS also agreed to donate 1.3 acres of 'excess' land to the Refuge as part of the mitigation required for impacts from their Dixon Landing/I-880 interchange project. The Caltrans project would impact a small portion of State owned land which is leased to the Refuge. To offset the loss to the Refuge of this leased land, Caltrans will donate 1.3 acres of marsh near the intersection of State Highway 84 and Thornton Avenue. The marsh property is hydrologically connected to the Refuge's Avocet and LaRiviere marshes.

2. Easements

Pacific Gas & Electric Company (PG&E) requested a Special Use Permit to install an optical ground wire containing a fiber optics cable on one existing transmission tower on the Refuge's Munster parcel and two existing towers on the Mayhews Landing parcel. All work was done in January with helicopters with no ground impacts. Large numbers of waterfowl and shorebirds flew out of Mayhews Landing when the helicopter worked in that area.

PG&E believed that their existing transmission line right-of-way included the right to install fiber optic cables. The Department of Interior's Solicitor's Field Office in San Francisco, believed that PG&E's right-of-way did not include fiber optic cables. We agreed to allow PG&E to install the cables in January with a Special Use Permit when PG&E agreed to meet with Refuge and the Solicitor's staff to resolve the right-of-way issue.

Near the end of 2000, PG&E submitted a request for another Special Use Permit to install two fiber optics cables on transmission towers located on Refuge property at Bair Island adjacent to Highway 101. The Refuge refused to issue the SUP until we resolved the right-of-way issue for the Munster, Mayhews Landing and the proposed Bair Island fiber optics cables. PG&E finally submitted a request for an amendment to their existing right-of-ways to include the right to install fiber optic cables. The right-of-way package including NEPA & Compatibility Determination was completed and forwarded to the CNO office in November, 2000 with a projected installation date for the Bair Island cable in early 2001.

3. Other

In October, Cargill Salt announced that they were going to consolidate their salt production operations and offer 19,000 acres of salt ponds for sale to the Federal and State governments for \$300 million. See Attached Map. Some of these ponds are owned by Cargill and others are owned by the Refuge with Cargill offering to sell its salt making rights on these Refuge parcels. Cargill proposes to continue to operate its salt making facilities on its Newark Plant site and on Refuge property between the Alameda Flood Control Channel and the Union Pacific Railroad in southern Fremont. By 2001, an appraisal will be completed by the Service and the State of California to determine the fair market value of the lands being offered. It is hoped that most or all of these lands will be obtained by the governments and restored to provide a variety of wildlife habitat from tidal marshes to low salinity ponds.

D. PLANNING

3. Public Participation

Bair Island

A public scoping meeting was held on April 27th for the Bair Island Restoration and Management Plan (See Section D.4 below).

The Refuge hosted a Thank You event on August 30th for the 70 people most involved in the protection of Bair Island. The event was held at the Marine Science Institute facility on Redwood Creek with a view of Middle Bair Island. Light refreshments were served followed by short presentations from Refuge Complex Manager Marge Kolar, California Fish and Game representative Carl Wilcox, Peninsula Open Space Trust Executive Director Audrey Rust, and Congresswoman Anna Eshoo. A tour of Bair Island was taken on The Marine Science Institute's ship. The tour went from the junction of Redwood Creek and Smith Slough, a short way up Corkscrew Slough and out Redwood Creek into the Bay as far North as Steinberger Slough. Key points of interest were shown including areas to be restored on Inner, Middle and Outer Bair Islands, the ongoing Pacific Shores mitigation work at Deepwater Slough and at the San Francisco Airport mitigation work on Outer Bair Island at the junction of Redwood Creek and

Corkscrew Slough, as well as a variety of wildlife using the area. A local television crew filmed the tour. The event was well received.

Environmental Education Center



On February 26, 2000, the official boardwalk opening celebration was held at the Environmental Education Center in Alviso, CA to thank everyone who contributed to the “Buy a Board, Build a Boardwalk” campaign sponsored by the San Francisco Bay Wildlife Society. The 1,200 foot boardwalk begins with a gently-sloping ramp providing accessibility for those with mobility concerns. The trail then meanders across the wetlands of New Chicago Marsh, crossing old slough channels and joining another trail on the salt pond levee.

The “Buy a Board, Build a Boardwalk” campaign gave local residents, foundations and corporations the opportunity to own (“purchase”) part of the national wildlife refuge with a tax-deductible investment. Each gift size, beginning at \$100, was represented by a duck species common to the south bay wetlands of San Francisco Bay. Some of the foundations and corporations that donated to the campaign were Elizabeth and Stephen Bechtel, Jr. Foundation, Boole & Babbage, George & Ruth Bradford Foundation, Gabilan Foundation, Lockheed Martin, Quantum Corporation, and the Dean Witter Foundation.

Colorful exhibits are being funded by the California Coastal Conservancy and will be added along this boardwalk to help school children and families visiting on weekends learn about the salt marshes, endangered species and migratory birds of the bay.

The boardwalk was completed in December 1999 and built by a crew from the California Environmental Project. This is a non-profit organization dedicated to protecting and preserving the natural resources of America and educating citizens on natural resource ethics.

Northeast San Jose Transmission Reinforcement Project Meetings

The California Public Utilities Commission (PUC) held public meetings at the Environmental Education Center concerning PG&E's proposed Northeast San Jose Transmission Reinforcement Project. They held an informational meeting on July 6th and a public hearing with a PUC Administrative Judge on July 11th. Several of the proposed alternative routes would impact the Refuge. The meetings were poorly attended by the public.

4. Compliance with Environmental Mandates

In compliance with NEPA & CEQA regulations, a public scoping Open House was held on April 27, in Redwood City for the Bair Island Restoration and Management Plan. A notice was published in the Federal Register and it was advertized in local papers. A one-month comment period was also used for written comments. The Open House was attended by 125 people and staffed by Refuge and Sacramento Office personnel. Project Leader Marge Kolar welcomed the public and Refuge Manager Clyde Morris gave a slide show on Bair Island and the planning process for its restoration. A summary of all public comments was published on the Refuge's Web site. Most of the public comments focused on Public Use issues; where will the public be allowed to go on Bair Island and what will they be allowed to do. Press coverage on the Open House was favorable.

5. Research and Investigations

a. Distribution of the California Tiger Salamander on the Warm Springs Seasonal Wetland Unit:

Biology Intern Rachel Hurt along with many volunteers, monitored the 1999-2000 breeding population of the California tiger salamander, *Ambystoma californiense*, on the Warm Springs Seasonal Wetland Unit. A population census was conducted to obtain an estimated population size in one pond, 4B, and to gather other baseline data on this isolate California tiger salamander (CTS) population to better manage the area for CTS. A total of 44 salamanders were caught along with an additional 40 recaptures. The estimate population for Pond 4B was calculated to be 52. A drift fence, lined with funnel traps, instead of the customary pitfall traps, was used and successfully captured salamanders. Dip-netting of other ponds at this site resulted in the capture

of several CTS larvae. A report followed the study with recommendations for management of the site for CTS.

b. Genetic Research on the California Tiger Salamander:

H. Bradley Shaffer from the Section of Evolution and Ecology, University of California Davis was sent toe clippings from Tiger Salamanders on the Warm Springs Wetland Unit. These will be used as a part of the genetic research he is conducting on the species. The Refuge has not received a follow-up report on his investigation.

c. Avian Predator Survey at Selected Sites on and near Don Edwards San Francisco Bay NWR:

Refuge Intern Jackie Finck surveyed avian predator presence in the East San Francisco Bay area, in three areas -Highway 84, Warm Springs, and Baumberg during the Spring/ Summer 2000. Sixty-seven avian predator surveys were conducted in a 14 week period, with 405 avian predator sightings recorded. Additional surveys, called avian behavior landfill surveys, were conducted at Newby Island Landfill and Recyclery and Tri-Cities Recycling and Disposal Facility. Twenty landfill surveys were completed within the same 14 week period, with 393 avian predator sightings recorded. Species, group size, time of day, and behavior were recorded for each survey. Common Ravens, Northern Harriers, and Red-tailed Hawks were the most common species recorded throughout the avian predator surveys. Common Ravens were the most common species recorded throughout the landfill surveys. Data was analyzed by area and time of day and species group sizes. Behaviors were also compared between areas and different times of day. Northern Harriers and Red-tailed Hawks behaviors did not vary much between sites, however Common Ravens behaviors varied at each site. Observations of Harriers, Red-tailed Hawks and Ravens, diurnal avian predators, were more likely to be detected than nocturnal avian predators during observation times. Hence, there is a survey bias toward observations of diurnal avian predators and against nocturnal avian predators. Even so, these three species are very common in the East Bay and occur in the threatened Western Snowy Plover (*Charadrius alexandrinus*) habitat, therefore are potential plover predators. The research will help determine any trends in avian predator populations and behaviors around local the Western Snowy Plover nesting areas and will assist the Refuge in determining whether an avian predator management program for Plover nesting habitat is necessary.

d. Western Snowy Plover Surveys:

Megan Marriot led Refuge biologists and volunteers in the monitoring of the year 2000 breeding population and nests of the Pacific Coast Western Snowy Plover (*Charadrius alexandrinus*) on the Refuge and on the California Department of Fish and Game's Eden Landing Ecological Reserve (ELER). She also banded Snowy Plover chicks as part of the first Snowy Plover (SNPL) banding program on the Refuge. Chicks were banded with a USFWS metal band on one leg and

a color band on the other leg. This was the first SNPL banding program to be conducted on the Refuge since the monitoring program began in 1992.

Nesting locations included, N1/N1, Crescent Pond, A22, Hickory, Patterson, N4/Bay, Ravenswood, and H84 shoreline. Ravenswood and N4/Bay were the only locations where SNPLs nested in 2000, but not in 1999. SNPLs did not nest on any levees north of H84, whereas SNPLs nested on these levees in 1999. Nesting SNPLs were not observed this year on Marshlands Road/N2, Marshlands Road/N4S, N2, N2/N3 or N1/PP1. SNPLs were found feeding and roosting in all areas where they were found nesting, and were also spotted feeding and roosting on N4/N6, N6/N9, N4A/N3A, and Marshlands Road/N2. Plovers made 27 nests on the Refuge, 18 (67%) of which were successful and two (7%) of which were predated. Plovers made 41 nests on the ELER, 20 (49%) of which were successful, and 13 (32%) of which were predated. Nests surrounded by topped predator enclosures were predated this year for the first time, on both the Refuge and ELER. Nest numbers were approximately 40% lower on the Refuge and 75% higher on ELER than in 1999. This dramatic shift in nesting concentration is likely due to a reduction of suitable levee nesting habitat on the Refuge since 1999 due to levee maintenance by Cargill. Fledgling success for 2000 was not estimated.

During the 2000 breeding season, nest predation was minimal on the Refuge, but was high on ELER. Only two (7%) nests on the Refuge were predated, whereas 29% of the Refuge nests were predated in 1999. One of these two predated nests was located on A22 and was exclosed prior to predation. The other predated nest was located on Crescent Pond and was not exclosed. Both nests disappeared long before the expected hatching date.

Thirteen (32%) of the 41 nests made within ELER were predated. Six of the predated nests were exclosed and located on 16B. The other seven were unexclosed and located on 16B, 13B and 7C. Two of the exclosed-predated nests, and all of the unexclosed-predated nests had egg substance and large shell pieces next to the nest cup. Four of the exclosed-predated nests, however, appeared totally undisturbed, except that the eggs disappeared well before the expected hatching date, no signs of tiny eggshell fragments from piping were present within the nest cups. No predator tracks or other predator signs were found at these four nests, and we were unable to determine the predator species responsible. Avian predators were a likely suspect in these cases and a study of avian predators was conducted (see D-5c).

In addition to the annual monitoring and banding program, Ms. Marriott began conducting a SNPL nest characterization on each nest located, as part of her Master's Thesis research. Results will be included in the Master's Thesis (expected July 2002).

e. Richmond Bridge Harbor Seal Survey:

Hal Markowitz, Deborah Green, Emma Grigg, and Sarah Allen. Caltrans and San Francisco State University conducted surveys of harbor seals on the Refuge. This multi year project is studying the potential effects of the seismic retrofit of the Richmond-San Rafael Bridge on the

harbor seals (*Phoca vitulina richardsi*) at Castro Rocks, located just beneath the bridge. The project includes regular monitoring of two alternative haul out sites including Mowry Slough that may be affected as a function of disturbance of harbor seals at Castro Rocks. A maximum number of 90 pups were onsite at Mowry Slough in 2000 compared to 78 pups in 1999.

f. Map and Monitor Invasive Cordgrass:

The California State Coastal Conservancy formed the San Francisco Estuary Invasive Spartina Project (ISP). The ISP is a regionally coordinated effort to control invasive cordgrasses in SF Bay. The first task of the ISP was to map invasive cordgrass species (*Spartina*) in SF Bay marshes. The findings from this survey and other surveys around San Francisco Bay will be compiled into an updated map of invasive *Spartina* populations in the bay region. The map will be used for planning invasive *Spartina* control strategies. The results of the study will be available in 2001.

g. Monitoring Tidal Marsh Habitat Restoration and Bird Use on Bair Island:

Point Reyes Bird Observatory (PRBO) in collaboration with the San Francisco Bay Bird Observatory (SFBBO), extended it's field work for it's larger "Tidal Marsh Project" to Bair Island. PRBO has been studying mature tidal marsh and restored tidal marshes since 1996 with a focus on tidal marsh-dependent birds and their management needs. They study and monitor success of tidal marsh restoration efforts throughout San Francisco Bay. This would continue the collaboration with SFBBO which was begun in the fall of 1999. It is their intention to continue studies after restoration begins and to track the process over time.

Point Counts and Modified Area Search/Transect Survey Counts were conducted at several points along levees and PG&E boardwalks on Inner, Middle, and Outer Bair Island. Surveys are conducted once every two months. They also conduct vegetation surveys 2-4 days per year.

h. Bay Trail Wildlife and Public Access Study - Redwood Shores:

The San Francisco Bay Trail is doing research to assess the effects trail users have on the immediate behavior of birds and on bird species abundance and diversity in salt marsh habitats next to public trails, compared to non-trail sites. They are in the second year of their study. Their public trail site at Redwood Shores is located behind the fire station on Redwood Shores Parkway. They moved their non-trail study site to Refuge property behind the sewage treatment plant on the outboard levee near the mouth of Steinberger Slough. The study is being led by a research team from San Jose State University, Dr. Lynne Trulio and Jana Sokale. The study on Refuge property will extend into 2001.

i. Sediment Dynamics in Intertidal Wetlands in South San Francisco Bay:

John Callaway of the University of San Francisco began a study of the sediment dynamics in intertidal wetlands in south San Francisco Bay by evaluating historic rates of vertical sediment accretion, current rates of sediment accretion, and current changes in wetland relative elevation. Measurements of these three parameters are being made at Greco Island and along the northern edge of Coyote Creek in low-marsh areas dominated by *Spartina foliosa* and in mid-marsh area dominated by *Salicornia virginica*. Sediment cores were collected in order to measure historic rates of vertical sediment accretion. Current sedimentation rates are being assessed using feldspar marker horizons set in the marshes at the two Refuge locations. The measurements at the established feldspar marker horizons will be taken annually for at least the next three years (until fall 2003). This information will be useful in developing restoration plans in the South Bay.

j. Bird Use of Salt Ponds

After a first year feasibility study in 1999 titled San Francisco Bay Bird Habitat Project, PRBO started what they hoped would be a multi year study of bird use of salt ponds and marshes titled San Francisco Bay Wetland Project. Their objective is to determine how different Bay habitats support diverse bird populations so that we can predict more accurately the gains and losses to various species from restoring one habitat type to another type in San Francisco Bay. Specifically, they are determining bird use of salt ponds which have the potential to be converted to other types of habitat such as tidal salt marshes. They are working towards identifying features of salt ponds (water depth, salinity, levee structure) and salt marshes (degree of channelization, water ponding, vegetation height) which are important to different species of aquatic birds.

The study will be conducted at least through April 30, 2001, with results available in late 2001. This information will assist the Refuge in designing interim management guidelines for any South Bay salt ponds which may become available to the Refuge.

k. Assessment of Avian Exposure to Mercury, Selenium and PCB Contamination in San Francisco Bay:

The U.S. Fish and Wildlife Service Division of Environmental Contaminants is working with the Regional Water Quality Control Board to establish the Total Maximum Daily Load (TMDL) for Mercury in the San Francisco Bay. One component of this TMDL is the protection of wildlife and their habitat with the Bay. This monitoring effort would establish a baseline exposure level for mercury in avian species with the Bay.

They collected up to 5 eggs per the following species: western snowy plover, black-necked stilts, Caspian tern, Forester's tern, black-crowned night heron, snowy egret and California gull. To

lessen impacts of the collection trips, they were coordinated with the San Francisco Bay Bird Observatory's monitoring efforts.

l. Study of Settlement Patterns of the Introduced Chinese Mitten Crab:

The Marine Science Institute of the U.C. California at Santa Barbara conducted a study of the settlement patterns of the non-indigenous mitten crab, *Eriochier sinensis*. The study results would have been used to address potential control issues of the crab. They suspended poly line with kitchen Tuffies (scrub pads) on the Dumbarton Fishing Pier with the intention of checking the lines every two weeks. Unfortunately, the lines and Tuffies were disturbed by the public too often and the researchers canceled the use of the fishing pier for the study.

m. Study of Water Quality in South San Francisco Bay:

The City of San Jose initiated a water quality monitoring program in the lower part of Artesian Slough, Coyote Creek, Alviso Slough, and Gualalupe Slough. The investigation is to provide data on salinity changes affecting salt marsh vegetation and aquatic communities. San Jose has been under pressure to reduce the fresh water outflow from their sewage treatment plant because it has, over past years, converted salt marshes which provide prime habitat for the endangered California clapper rail to brackish marshes which provide poor habitat for the rail. This study would provide additional insight into this issue.

n. Study of Sediment Transport and Hydrodynamics in Tidal Wetlands in Artesian Slough and Coyote Creek:

Rachel Simons of the Department of Civil & Environmental Engineering at Stanford University measured salinity, temperature and suspended solids in Artesian Slough and Coyote Creek in order to investigate the impact of wastewater discharge on salt marsh hydrodynamics and sediment transport. The observations revealed intermittent stratification with strong longitudinal and vertical salinity gradients and consistent suspended solids patterns over varying time scales. The longitudinal salinity gradients in one channel ranged from 0.0018 ppt/m on high tide to 0.00053 ppt/m on low tide. The vertical salinity gradients ranged from 5.0 ppt/m on high tide to 0.026 ppt/m on low tide at the same location in the channel. The suspended solids measurements varied consistently in magnitude over a single tidal cycle and the 14-day spring/neap cycle.

m. Study of Peregrine Falcons in Vicinity of Dumbarton Bridge:

Brian Walton of U. C. Santa Cruz's Predatory Bird Research Group conducted studies on peregrine falcons in the vicinity of Dumbarton Bridge. This species had nested on the bridge in recent years with the Research Group conducting similar studies each year. He determined the status of the falcons, captured, banded and obtained blood samples for toxicology studies and banded the young.

n. **Bair Island Visitor Use Survey:**

Sequoia Audubon Society conducted a survey of visitor use on Inner Bair Island from September 1, 1999, to December 2, 2000. Based on these surveys, it was estimated that 250,000 visits per year occur on this 3 mile trail. Fifty-six percent come to hike or walk, 35% to jog, 9% to bicycle. Thirty-eight percent of all human visitors bring a dog.

E. ADMINISTRATION



Back row - left to right: Marc Webber, Clyde Morris

Front row - left to right: Marge Kolar, Cindy Lu, Carolyn Wang, Andree Carminer



**Staff & Interns from SF Bay NWR Complex, Murre Project, USDA Wildlife Service, and
SF Bay Wildlife Society (all working at the Refuge)**

Back row - left to right: Hugh Morrison, Christine Schelin, Clyde Morris, Matt Gay, Mike Parker, Bryan Winton, James Alberti, Genie Moore

Third row - left to right: Ross Wilming, Tory Slowik(partly hidden), Joy Albertson, Marty Murphy, Ingrid Harrauld, Carmen Leong, Jamie Ruffenach, Marc Webber, Jon Adamson, Donnie Bennet, Frances McTamaney

Second row - left to right: Marge Kolar, Christen Hamilton, Kate Taylor, Jutta Lamperstoffer, Sandy Spakoff, Carolyn Wang, Cindy Lu, Diane Kodama

Front row - left to right: Donnie Simms, Juan Flores, Sharon Lee, Joelle Buffa, Kapala Kamoho, Andrea Carminer, Jackie Finck, Louise Vicencio, Barry Tarbet

I. Personnel

| | | | | |
|-----|-------------------|-------------------------------|-------|-----|
| 1. | Marge Kolar | Project Leader | GM-14 | PFT |
| 2. | Marc Webber | Deputy Project Leader | GS-13 | PFT |
| 3. | Clyde Morris | Don Edwards SFBNWR Manager | GS-12 | PFT |
| 4. | Jon Adamson | Police Officer | GS-7 | PFT |
| 5. | Barry Tarbet | Police Officer | GS-8 | PFT |
| 6. | Christopher Barr | Salinas/Ellicott Manager | GS-12 | PFT |
| 7. | Arthur Chan | Maintenance Worker | WG-8 | PFT |
| 8. | Juan Flores | Maintenance Worker | WG-8 | PFT |
| 9. | James Griffin | Maintenance Worker | WG-8 | PFT |
| 10. | Vicki Trabold | Gardener | GS-4 | TFT |
| 11. | Carolyn Wang | Administrative Assistant | GS-7 | PFT |
| 12. | Andrea Carminer | Purchasing Agent | GS-5 | PFT |
| 13. | Joan Dawson | Clerk-Typist | GS-4 | PFT |
| 14. | Cindy Lu | Budget Assistant | GS-6 | PFT |
| 15. | Chris Bandy | Alameda/Antioch Dunes Manager | GS-12 | PFT |
| 16. | Bryan Winton | San Pablo Bay Refuge Manager | GS-11 | PFT |
| 17. | Louise Vicencio | San Pablo Bay Biologist | GS-11 | PFT |
| 18. | Rudy (Matt)Gay | Chief of Visitor Services | GS-12 | PFT |
| 19. | James Aliberti | Volunteer Coordinator | GS-7 | PFT |
| 20. | Carmen Leong | Outdoor Recreation Planner | GS-9 | PFT |
| 21. | Frances McTamaney | Environmental Education Spec | GS-11 | PFT |
| 22. | Genie Moore | Environmental Education Spec | GS-7 | PFT |
| 23. | Sandy Spakoff | Environmental Education Spec | GS-9 | PFT |
| 24. | Joelle Buffa | Supervisory Biologist | GS-12 | PFT |
| 25. | Joy Albertson | Wildlife Biologist | GS-11 | PFT |
| 26. | Diane Kodama | Wildlife Biologist | GS-5 | TFT |
| 27. | Ivette Loreda | Wildlife Biologist | GS-9 | PFT |
| 28. | Bart McDermott | Refuge Operations Specialist | GS-7 | TFT |
| 29. | Mike Parker | Wildlife Biologist | GS-11 | PFT |
| 30. | Ross Wilming | Wildlife Biologist | GS-5 | TFT |
| 31. | Keith Gauldin | Refuge Operations Specialist | GS-7 | TFT |

Common Murre Restoration Project

Project Director: Michael Parker
Project Biologist: Christine Hamilton
Ingrid Harrauld
Hugh Knechtel
Marty Murphy
Tory (Victoria) Slowik
Stephen Kress
Project Outreach: Sarah Boehm

San Francisco Bay Wildlife Society

Jamie Ruffenach
Sharon Lee

Interns

Winter

Jackie Finck, Ross Wilming, Rachel Hurt, Hester Stafford, Julie Warr, Carrie Teiken

Spring

Jackie Finck, Ross Wilming, Jennifer Brownlee, Cara Rancourt, Jutta Lamperstoffer, Kate Taylor

Summer

Kapala Kamoho, Christine Schelin

Fall

Mika Kakizaki, Natalie Doerr, Trina Schnieder, Alexandra Lutnik, Cecilia Rejas

The following personnel changes/actions occurred during 2000:

| <u>Name</u> | <u>Position/Grade</u> | <u>Action</u> |
|--------------------|---|----------------------|
| Brian Allen | Sup. Refuge Operations Specialist GS-9 | Transfer 12/31/00 |
| Chris Bandy | Refuge Manager GS-12 | Career Appt 11/05/00 |
| Chris Barr | Refuge Manager GS-12 | Transfer 7/16/00 |

| | | |
|-----------------|---------------------------------------|-------------------------|
| Andrea Carminer | Purchasing Agent GS-5 | Career Appt 07/02/00 |
| Joan Dawson | Office Automation Clerk GS-4 | Removal 01/07/00 |
| Keith Gauldin | Refuge Operations Specialist GS-7 | Resignation 04/05/00 |
| Matt Gay | Supvy. Outdoor Recr Planner GS-12 | Transferred 10/07/00 |
| Diane Kodama | Wildlife Biologist GS-7 | Conv to Career 11/19/00 |
| Ivette Loreda | Wildlife Biologist GS-11 | Promotion 08/27/00 |
| Cindy Lu | Budget Technician GS-6 | Conv to Career 01/14/00 |
| Cindy Lu | Admin. Support Assist. GS-7 | Promotion 11/19/00 |
| Bart McDermott | Refuge Operations Specialist GS-5 | Term Appt 09/10/00 |
| Vicki Trabold | Gardener GS-4 | Termination 07/29/00 |
| Carolyn Wang | Admin. Support Assist. GS-7 | Transferred 7/29/00 |
| Marc Webber | Deputy Refuge Manager GS-13 | Transferred 11/18/00 |
| Ross Wilming | Biological Science Technician GS-5 | Exc Appt 09/18/00 |
| Ross Wilming | | Termination 10/17/00 |

2. Youth Programs

Boy Scouts and Girl Scouts

During 2000, 4 Refuge employees were involved with Scouting and Scout Programs: the Outdoor Recreation Planner, the Volunteer Coordinator and the Environmental Education Specialist at the Visitor Center in Fremont, and the Interpretive Specialist at the Environmental Education Center in Alviso.

Scout groups contacting the Refuge for programs had a variety of options. Upon request, some scouting groups received tailor-made interpretive programs to help fulfill badge or merit requirements. Other groups opted to volunteer on typical Refuge projects, such as maintaining trails, helping out at the Native Plant Nursery or participating in a Refuge clean-up. Others enjoyed a short, informal talk about Fish and Wildlife Service careers and related Refuge topics.

All programs helped fulfill the Scout's merit requirements while allowing the Refuge to educate about its habitats and conservation issues. For instance, the Girl Scout Bay Care Patch program could be used to teach about watersheds, the salt marsh as part of the watershed, and pollution prevention in the watershed, all through observations in data books with a few activities before and after the walk. In slight contrast, the Cub Scouts Achievement 5 walk incorporated the mission of the National Wildlife Refuges, careers at Refuges, endangered species, and pollution prevention into an activity walk. After completing these programs, many Scouts also participated in a Refuge clean-up or chemical-free garden clean-up. The Achievement 5 walk was particularly popular, being listed in the Santa Clara Valley Scout Field Trip Guide.

Scout Program Statistics

Seventy-seven Scouts logged a total of 749 hours at the Native Plant Nursery, on trails, and on special projects. At the Environmental Education Center, 106 scouts participated in over 20 hours of interpretive programs, including map adventures, tours, and a birding workshop. At Refuge headquarters in Fremont, 230 girl scouts participated in the Wetland Round-Up Field Trip program, 7 girl scouts helped make tiger salamander traps for Warm Springs, 25 Boy Scouts participated in planting endangered plants at Antioch Dunes NWR, and over 100 Boy/Cub and Girl Scouts received talks about careers, the Refuge, migration, and other wildlife related topics. Scout groups were also pivotal in helping clean up the Refuge at the two Refuge clean-up events (Earth Day and Coastal Clean-up), comprising over 100 individuals in the two events combined.

4. Volunteer Programs

The Refuge has an extensive volunteer program. Each year, volunteers allow the Refuge to tackle projects it would otherwise not be able to support. Regular volunteers, occasional and one-time volunteers, and Student Conservation Association (SCA) interns participated in biological and resource management projects, special events, interpretive programs and a number of visitor services duties, environmental education programs, maintenance projects, office projects, and Native Plant Nursery work. In the year 2000, 1,376 volunteers contributed 27,369 hours of labor

at sites throughout the Complex. 18 volunteers fulfilled community service obligations to city or county courts, ranging from 20 to 120 hours, with most needing to complete 40 hours.

Volunteer Recruitment and Training

The Refuge tries to accommodate the different interests and needs of its volunteers. Some volunteers choose to become regular Refuge volunteers. Before getting to work, these volunteers must fill out a short application, asking for their background and interests. Volunteers may specify the types of projects they would be interested in working on, and the Volunteer Coordinator matches their interests to the Refuge's needs. Some volunteers are only interested in one area, such as staffing the visitor center desk or leading interpretive programs, while others wish to gain experience in all aspects of operating a National Wildlife Refuge. All regular volunteers are entered into a database, where they can be accessed by name, interest, proximity to Refuge sites, etc. When projects requiring volunteers arise, either the staff member leading the project or the Volunteer Coordinator contact those volunteers who indicated an interest in the project area. Regular volunteers must also sign a Volunteer Services Agreement, which protects them in case they are injured during a volunteer project. A volunteer application is attached at the end of this narrative.

The Refuge also has one-time volunteers, who come to the Refuge only once or twice, usually for large events such as the Earth Day clean-up or Coast Clean-up. These volunteers are not required to fill out an application, though they must complete a Volunteer Services Agreement.

All regular volunteers attend two 3- hour volunteer trainings. These trainings are offered throughout the year, and they provide an opportunity for the Volunteer Coordinator to talk with each volunteer individually. They also allow volunteers to become better acquainted with the Refuge as a whole, as well as to learn the details of their particular project area. If volunteers have not decided on an area of interest, they may choose one or more at this training. Volunteers watch videos, hear guest speakers, and receive a packet filled with Refuge information. The Volunteer Coordinator also tries to arrange the volunteers' schedules at this time.

Student Conservation Association Internships

Student Conservation Association interns play an integral role in the Biological Management and Visitor Services programs at the Refuge. In 2000, 18 interns each contributed 40 volunteer hours a week for a 12- to 17- week period. In return, they received housing and a \$50/week stipend. The environmental education interns assisted staff with the development and organization of the environmental education programs at the Don Edwards SFBNWR and at the San Pablo NWR. They developed materials for the Wetland Round-Up Field Trip program, Trekking the Refuge Field Trip program and the three Summer Day Camps. The visitor services intern staffed the visitor center desk, led interpretive programs and completed other visitor services projects. The biology interns participated in clapper rail surveys, legless lizard surveys, butterfly counts, non-native plant eradication and other management duties.

Volunteer Recognition and Awards

In order to recognize volunteers for their outstanding contributions to the Refuge, staff members hold a volunteer banquet once a year. Since staff members in all departments benefit from volunteer assistance, all staff members are encouraged to come and attendance is usually high. This year, the Annual Volunteer Banquet was held at the Fremont headquarters and coincided with National Volunteer Week. Volunteers received Certificates of Appreciation and gifts such as reusable, insulated lunch bags, posters, pen sets, plaques, and gift certificates. In addition, volunteers who had accumulated hours in increments of 500, 1,000 and more, were recognized with special pins and other awards. The honor of **Volunteer of the Year** went to Harry Sanders, volunteer manager of the Native Plant Nursery for the past 10 years. After dinner and the awards ceremony, the Volunteer Coordinator presented a video explaining the Common Murre Project.

Volunteer Projects

Biology and Resource Management. Biological and resource management volunteers worked at the main and satellite refuges. Activities included habitat restoration, monitoring and censusing of endangered and threatened species, planting of native grasses and shrubs, weeding of non-natives, and data entry and analysis. At the Don Edwards San Francisco Bay NWR volunteers participated in clapper rail bird call counts and surveys, planting native plants, alien plant eradication, butterfly garden monitoring, and cleaning, painting, and mounting decoys for the Common Murre Restoration Project. Many biology projects, such as the clapper rail surveys, allowed volunteers close-up views of wildlife they may not have otherwise seen.

At satellite refuges, volunteers participated in biology projects such as the annual butterfly count and evening primrose planting at Antioch Dunes NWR, surveying black legless lizards, and erecting snowy plover enclosures at Salinas River NWR, weeding non-native grasses and planting native grasses at Ellicott Slough NWR. Volunteers also played an important role at San Pablo Bay NWR and at the Farallon NWR.

Visitor Services. Volunteers staffed the Visitor Center approximately 75% of the time (90% of the time if you include the SCA intern), patrolled Refuge trails, and presented almost all weekend interpretive programs, including walks, slide shows, and tours at the Fremont location. Volunteers also assisted in the office with large mailings, data entry, desktop publishing, and San Francisco Bay Wildlife Society (Society) memberships. Working with the Society, our cooperating association, volunteers continued to order books and other items for the Don Edwards San Francisco Bay NWR as well as Klamath, Sacramento, Malheur and Salton Sea NWR's.

Environmental Education. Volunteers contributed to the on-going success of the environmental education programs at both the Fremont and Alviso sites. Volunteers helped develop new activities and materials, assist with learning stations on field trips, and maintain the Butterfly and Migratory Songbird gardens. Some of our youngest volunteers shared their knowledge with their peers during the three Summer Day Camps. These volunteers, previous Summer Day Camp

graduates, helped staff members and other Refuge volunteers teach 3rd through 6th graders about the salt marsh and its ecological significance.

Special Events. Volunteers were vital to the success of many large Refuge events, including Coast Cleanup, The Flyway Festival, National Wildlife Refuge Week, Earth Day, International Migratory Bird Day, and Native Plant Sales. These events required so many hands, it would have been impossible for staff members to host them alone, and volunteers at these events were able to play strong leadership roles and enjoy much public interaction.

Sixteen Refuge volunteers assisted staff with the coordination of two cleanup events, Earth Day and Coast Cleanup, at the Fremont headquarters. Two hundred fifty-eight non-Refuge volunteers helped clean the Refuge along Marshlands Road, Mayhews Landing, Tidelands Trail and the Visitor Center Parking lot. BFI donated a 14-yard roll-off box and one 96-gallon recycling bin to the Earth Day Event, and volunteers filled a 20-yard box for Coast Cleanup. Refuge volunteers at the Earth Day event also helped sell plants at the Native Plant Sale. Also on Earth Day, 160 volunteers deployed by NUMMI, Lam Research, Lockheed Martin, and Enron and lead by seven Refuge volunteers eradicated non-native, invasive plant species at the Environmental Education Center. It was one of the largest one-day work parties in the history of the Center.

Native Plant Nursery. Volunteers Harry and Gretchen Sanders retired after almost 10 years of tireless efforts managing all aspects of the Native Plant Nursery. Before retiring, Harry also helped the new managers make the transition from a sales-oriented to a restoration-oriented operation. Harry received National Volunteer of the Year, and he and Gretchen traveled to Washington D.C. to be honored.

Work Parties

Many local businesses and corporations contact the Refuge to arrange a work party for their employees. Employees at these work parties volunteer to help with large Refuge projects, such as alien plant eradication and trash pick-up. Work parties from Sun, Cisco, Intel, Sony, Community Impact, and various Bay Area scout groups volunteered time in the Butterfly and Migratory Songbird Gardens at the EEC, weeding, spreading mulch, and laying ground cloth cover.

6. Safety

A fisherman drowned after turning over his boat in Newark Slough. More details on this incident is found under the Law Enforcement section. Other accidents included minor instances, such a tripping on uneven concrete, splinters from a wooden rail and a vehicle backing accident with property damage only. Only the trip required medical attention.

There were four safety presentations at each of the four quarterly staff meetings. Unfortunately, the topic of the safety presentations were recorded at only two of the meetings. The first recorded quarterly safety meeting was in July with 34 people in attendance. At this quarterly meeting we saw the film from the Department of Interior for "A Living Legacy Protecting Our

Most Valuable Resources". This film is about the work force and the reminder that safety in the work place is a paramount concern. The audience included the Murre project personnel, biology, wildlife services, satellite management, administration, private contractors, management, maintenance and interns.

The next quarterly safety meeting was the in October with 27 people in attendance. At this quarterly meeting we covered fire extinguished inspection and a new vehicle checklist. This included watching a video as to how to use a fire extinguisher, types of extinguishers, and this video was furnished by our regional safety office. The audience included the Murre project personnel, biology, wildlife services, satellite management, administration, private contractors, management, maintenance and interns.

8. Other Items

Revenue sharing payments totaling \$271,785.00 were paid as follows: Alameda County \$196,565.00; Santa Clara County \$22,926.00; and San Mateo County \$52,294.00.

F. HABITAT MANAGEMENT

2. Wetlands

The Refuge includes some of the largest remaining tracts of tidal salt marsh in south San Francisco Bay. These include Dumbarton, Mowry (North and South), Calaveras, Ideal, and Greco Island. Although most of these marshes were made much smaller by the creation of salt ponds in the late 1800s and early 1900s, they still retain the features critical to salt marsh dependent species. Many rare and endangered species depend on these marshes, including the California clapper rail (*Rallus longirostris obsoletus*), salt marsh harvest mouse (*Reithrodontomys saviventris*), Saltmarsh song sparrow (*Melospiza melodia pusillula*), and salt marsh wandering shrew *sorex vagrans*.

However, these marshes have been degraded by many human influences. Salt pond levees provide easy access to marshes for predators. Much of the high marsh has been lost to development, leaving marsh inhabitants with less refuge during extreme high tides and storm events. Rip rap along salt marsh levees creates fill in wetlands and provides cover for non-native predators including rats and red foxes. Marshes are further impacted by contaminants from municipal and industrial sources.

Studies and management have been designed to address these impacts and to monitor the status of salt marsh dependent endangered species. Cargill Salt Company provided its annual report of work to be done in salt ponds on the Refuge. Refuge staff provided comments to minimize impacts to wildlife. (See Section c. Cargill)

a. New Chicago Marsh

Active habitat management and restoration continued in the Refuge. Tide gates to New Chicago Marsh in Alviso are opened and closed to allow adequate water levels to maintain habitat for the Salt Marsh Harvest Marsh without causing flooding. The channel used for adding water from the New Chicago Marsh tide gate is silting inhibiting passage of tide waters.

Pumps at the Environmental Education Center are used to recirculate water in the New Chicago Marsh during the summer's low water period. This prevents stagnation until additional water is added at high tide.

b. Warm Springs Mouse Pasture

The Refuge coordinated its water management with the manager of the Bayside Business Park in South Fremont. The business park is next to the Refuge's Mouse Pasture and Coyote Creek Lagoon. The business park allowed tidal water to enter its storm water lagoon which is turn was allowed to pass through the tide gate to the Mouse Pasture to rehydrate the pickleweed marsh. This supplemented the normal accumulation of rain water in the marsh.

Several meetings were held with the City of San Jose, EPA, and other agencies to resolve the placement of asbestos-laden fill and 10 culverts near the Environmental Education Center in Alviso. These were placed there in 1983 during a flooding event to allow drainage of flood waters through New Chicago Marsh. The city capped the fill with asphalt to secure the asbestos but erosion has cause weak spots in the cap allowing vegetation to grow through the cap. The City is now hiring a contractor to study the removal of the asbestos material with a goal of full removal in 2001.

c. Cargill Salt Company

The Refuge contains approximately 9000 acres of solar salt evaporation ponds operated by the Cargill Salt Company. Unfortunately, when the Service gained ownership of the ponds, we did not obtain management rights to the area. Since Cargill Salt may continue to harvest salt in the ponds in perpetuity, the Refuge has little input in management of the ponds. This arrangement is detailed in an 18 page agreement between the Service and Leslie Salt Company (later sold to Cargill). See Section C-3 for information on a proposed sale of 19,000 acres of Cargill salt pond rights to the State and Federal governments.

10. Pest Control

Background

The refuge continued to be heavily involved in control of exotic plants. Control work focused on four plant species which are on the California Exotic Pest Plant Council's list of "Exotic Pest

Plants of Greatest Ecological Concern in California" (October 1999): giant reed (*Arundo donax*), French broom (*Genista monspessulana*), perennial pepperweed (*Lepidium latifolium*), and smooth cordgrass (*Spartina alterniflora*), as well several exotic grass species. Below are species descriptions for these four species. Additional work was conducted to control an invasion of prickly lettuce (*Lactuca serriola*), a native species known to invade disturbed areas.

Giant Reed: A robust perennial grass which grows from nine to thirty feet tall, growing in many-stemmed, cane-like clumps and often forming large colonies many meters across. Giant reed occurs in central and southern California, including the San Francisco Bay area. In our area, giant reed grows mainly in semi-saline soils at the margins of brackish marshes or in drainage ditches. It spreads vegetatively either by rhizomes or fragments. Giant reed displaces native plants and associated wildlife species, alters hydrological regimes, and presents fire hazards.

French Broom: An upright, evergreen shrub, which grows up to ten feet tall. French broom has small yellow flowers and produces seed in inch-long pods. It currently occupies about 100,000 acres in California, displacing native plants and forming dense monospecific stands. It grows on coastal plains, mountain slopes and in disturbed places. French broom foliage and seeds are toxic to livestock, displace native habitat, and increase fire danger. This species establishes a long-lived seedbank, making it difficult to eradicate.

Perennial pepperweed: A multi-stemmed herb growing three to eight feet tall, with a heavy crown and spreading underground root system. Pepperweed has tiny white flowers in dense clusters at the tops of the stems. Flowers from May to July. This species invades brackish to saline wetlands throughout California, as well as hay meadows and agricultural fields, and can be spread by seeds or by pieces of underground stems. It forms dense monospecific stands that exclude other plants. In San Francisco Bay, it poses a threat to habitat of the endangered salt marsh harvest mouse and California clapper rail.

Smooth cordgrass: Currently, four species of exotic cordgrass (*Spartina* spp.) have invaded the wetlands and tidal flats of San Francisco Bay, to the detriment of native species, communities and habitats. The California Exotic Pest Plant Council (CalEPPC) has given smooth cordgrass (*Spartina alterniflora*) a Class A rating, placing it in the "Most Invasive and Damaging Wildland Pest Plant" category. In San Francisco Bay, smooth cordgrass is viewed as an invasive species which critically threatens the native ecological integrity of the tidal wetlands and mudflats. Dense-flowered cordgrass (*S. densiflora*), salt-meadow cordgrass (*S. patens*), and common cordgrass (*S. anglica*) are all listed for Red Alert: "Species with Potential to Spread Explosively", but are currently restricted in size.

In order to address this San Francisco Bay-wide habitat threat, the California Coastal Conservancy, in cooperation with the USFWS, CDFG, and other affected landowners, formed the San Francisco Estuary Invasive *Spartina* Project (ISP). The ISP is a regionally coordinated effort to control invasive species of cordgrasses in San Francisco Bay. Due to the potential for all exotic *Spartina* spp. to invade intertidal areas and negatively impact native and endangered

wildlife, the ISP will include management of all exotic *Spartina* species. Currently, a Joint Programmatic Environmental Impact Statement/Environmental Impact Report is being prepared to examine the impacts of control methods being considered for use. The Refuge will conduct exotic cordgrass control under the authorities and permits of the ISP Management Plan, when it is completed.

Currently, smooth cordgrass (*S. alterniflora*) is the only exotic cordgrass species invading Refuge lands. It is a perennial, spreading grass from one to eight feet tall, which may hybridize with native cordgrass (*S. foliosa*). Flowering occurs from late July through September. Smooth cordgrass was originally established in San Francisco Bay in the late 1970s. Since that time, it has spread to numerous sites in the bay including patches in Dumbarton and Audubon marshes, large monotypic stands in several Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) marshes between the Dumbarton Bridge and the Alameda County Flood Control (ACFC) Channel, heavy to infrequent concentrations along the bay shoreline and tidal creeks north of ACFC Channel to San Leandro Bay, and several infestations along the west side of the bay between Palo Alto and the San Bruno Canal. There are approximately 200 net acres of smooth cordgrass on the Refuge at this time.

Smooth cordgrass is considered an invasive species because of its ability to spread rapidly and to colonize mudflats at elevations higher and lower than the native cordgrass. In particular, the spread of this species is likely to impact several endangered species, including the California clapper rail and the salt marsh harvest mouse. These two species depend on native marsh vegetation and structure for foraging, reproduction and cover, and may be severely impacted if stands of smooth cordgrass displace this habitat. In addition, smooth cordgrass invades tidal mudflats, which are important foraging areas for 500,000 to 1 million migrating and wintering shorebirds each year.

Refuge Control Program

a. Headquarters

French broom: An eradication project to remove French broom from Headquarters Hill was conducted by individual refuge volunteers, staff, and volunteer groups in the fall of 2000. Approximately 3/4 acre of French broom was cut or pulled and hauled off the hillside. The French broom had become established on the hillside within the last several years (from an unknown source) and was taking over native shrub/grassland habitat. Follow-up control will include pulling and spraying of sprouts by biologists and volunteers.

Giant Reed: Volunteers, lead by James Aliberti, cut, pulled and removed a 50'x50' patch of giant reed that had established next to the Pavillion. Biologists will conduct follow-up monitoring and will spray with Roundup-Pro® herbicide if necessary.

b. Warm Springs Seasonal Wetland

Prickly lettuce: In July, 56 acres of prickly lettuce was mowed just south of the Homestead Site on the Warm Springs Seasonal Wetland Unit. Staff had determined that the prickly lettuce was invading a substantial portion of the grassland area and that was impacting migration corridors and estivation habitat of California tiger salamanders (*Ambystoma californiense*) present on the site.

Exotic grasses: Twelve acres of exotic grasses were mowed in July around the two artificial burrows, installed for burrowing owls, just northwest of the Homestead Site. In August, additional hours were spent hand-mowing around the artificial burrows. Burrowing owls require short grassland foraging areas near their burrows in order to be successful.

Pepperweed: On June 14, two refuge staff conducted chemical control for pepperweed around the corral site and the duck club. A total of 55 gallons of spray solution, comprised of 4% Roundup-Pro® herbicide, was used for the control. Approximately 0.2 acres of pepperweed were sprayed. Invasions will be monitored and re-sprayed if necessary.

c. Salt Marsh Habitat

Pepperweed: Pepperweed chemical control with Rodeo® herbicide was conducted on 30 May and 9, 12, and 13 June, 2000. Control was conducted in marshes along Marshlands Road, the 5-mile loop trail, and Newark Slough. A total of 205 gallons of spray solution, comprised of 4% Rodeo® herbicide and 0.5% R-11® surfactant, was used for the control. Approximately 0.9 acres of pepperweed were sprayed using a combination of backpack sprayers, airboat-mounted sprayers and truck-mounted sprayers.

Smooth Cordgrass: In 2000, the Refuge conducted chemical control of smooth cordgrass in marshes on the east and west sides of south San Francisco Bay. A total of 46 acres of smooth cordgrass was sprayed. Control work was conducted with either with a truck-mounted sprayer, an ARGO tracked vehicle-mounted sprayer, a boat-mounted sprayer, or backpack sprayers. Refuge crews conducted spraying, but the majority of spraying was done by Refuge contractors and cooperators.

On the east side of the Bay, Refuge crews conducted 28 person-hours of spraying, treating 1.55 acres of smooth cordgrass in the Ideal Marsh area with a truck-mounted sprayer and backpack sprayers. A two-person crew from Alameda County Department of Agriculture spent 104 crew-hours (208 person-hours) spraying with a truck-mounted sprayer in the Ideal Marsh and LaRiviere Marsh areas, treating 27 acres of smooth cordgrass. Two-person ARGO crews from Alameda County Mosquito Abatement District spent 40 crew-hours (80 person-hours) treating 7.34 acres in LaRiviere Marsh and Mowry Marsh.

On the west side of the Bay, San Mateo County Mosquito Abatement District used boat-mounted sprayers and ARGOS to treat 10.1 acres of smooth cordgrass along the shores of San Mateo County from San Francisco Creek to Belmont Slough. They spent 148.25 person-hours on the effort.

The chemical solution applied to the plants consisted of 5% Rodeo® herbicide, 0.5% R-11® surfactant, and 0.5% Blazon Blue® Indicator Dye. The solution was applied on a spray-to-wet basis onto green stems. Rates and volumes of solution are prescribed by the Rodeo® label.

Note: All chemical methods discussed refer to the use of Rodeo® herbicide (Monsanto Co.), R-11® surfactant (Wilbur-Ellis Co.), and Blazon Blue® Spray Indicator Dye (Milliken Chemical) to control exotic *Spartina* spp. The use of product names in this report is only for the purpose of illustration and does not constitute an endorsement of the product.

Rodeo® is a broad spectrum, post-emergent herbicide containing 53.8 percent glyphosate (active ingredient) and 46.2 percent water. Glyphosate has been used worldwide in both agricultural and forestry practices to control undesirable plant species. The primary mechanism for uptake of glyphosate through the plant is from the sprayed foliage into the root system. Glyphosate inhibits the synthesis of essential amino acids in plant tissue. Currently, Rodeo® is the only herbicide in California registered for estuarine use and is labeled for aquatic use in the state. Rodeo® has been proven to be effective if certain variables, such as application method, wind, exposure time, and application rates are optimized.

The recommended season for application of Rodeo® to smooth cordgrass is from May through November, prior to seed set. The plants should be exposed (not tidally inundated) prior to spraying, so that the foliage is dry to absorb the herbicide. The most critical factor in determining the efficacy of the application is the exposure time after spraying and prior to inundation, with 6-10 hours drying time recommended.

G. Wildlife

2. Endangered and/or Threatened Species

a. California Least Terns

The California Least Tern has not nested on the Don Edwards San Francisco Bay NWR since they abandoned their former nesting site on Outer Bair Island in the mid 1980s. However, they continue to forage in the lower salinity salt ponds in the South Bay during the late summer months. This post-breeding use includes adults and juveniles still being fed by adults and learning to forage on their own. The clear waters, shelter, and impounded fish populations provide important feeding and roosting habitat for these birds.

The Refuge Complex is now becoming involved in monitoring the California Least Tern nesting colony at the former Alameda Naval Air Station. The area is being proposed as the next National Wildlife Refuge in the San Francisco Bay NWR Complex.

b. California Clapper Rail

Clapper Rail Breeding Season Call Count Surveys:

Refuge personnel and volunteers under the direction of Refuge Biologist Joy Albertson conducted breeding season call count surveys on six occasions between March 23 and April 5. Survey methods followed the protocol of Zembal and Massey (1981) and are used to estimate the density of breeding rails. Annual breeding season surveys provide an index to the health of breeding rail populations. Results of the surveys are also used to supplement our winter airboat survey data in areas that airboat surveys could not be conducted.

Breeding season call count surveys were conducted in the mornings or evenings between mid-February and mid-April in selected marshes. Morning surveys were conducted from 45 minutes before sunrise to 1 1/4 hours after sunrise and evening surveys are conducted from 1 1/4 hours before sunset to 45 minutes after sunset.

Results of surveys are reported in Table 1. The portion of Alameda Flood Control Channel (ACFCC) east of the "Patterson Area" and Mowry Slough North were surveyed once and LaRiviere Marsh was surveyed twice, to obtain an estimate of the breeding population. These marshes had 12, 9, and 19 breeding rails, respectively.

Surveys in the ACFCC recorded 12 breeding rails, which represented 8-9 pair of rails. Rails were heard at most survey stations along the survey route, but were most numerous at the mouth of the ACFCC. No rails were recorded within 1/2 mile of Coyote Hills. Since breeding rails were so numerous and widespread over most of the surveyed area, exotic cordgrass control was not conducted in this area during the breeding season, except near Coyote Hills.

LaRiviere Marsh is a former salt crystallizer pond which has been restored to tidal marsh. This year, our surveys showed nine breeding rails, which represented six breeding pair. One of the "Clappers" was heard in the "Avocet Marsh" portion of the area and the rest in the largest tidal area. This is the first organized clapper rail survey we have conducted in LaRiviere Marsh. Surveys were conducted using the stationary survey method, since the marsh is fairly wide.

The Mowry Slough Marsh surveys were conducted from the levee along the north side of the slough. The area surveyed was between the "waste pile" and the intersection of the main levee with the first cross-levee. This year, our surveys recorded 19 breeding rails, which represented 11 breeding pair.

CLAPPER RAIL BREEDING SEASON SURVEYS
 March-April 2000
 Don Edwards San Francisco Bay National Wildlife Refuge

| Date(s) | Location | California clapper rail calls | | | | Total Breeding Rails= (Dx2)+C |
|-----------|---|-------------------------------|----------------|------------|---------------------|--|
| | | Duet (D) | Clapper (C) | Kek (K) | Kek- burr (B) | |
| 3/23-30 | Alameda County Flood Control Channel (ACFCC) | 3 | 6 | 0 | 0 | 12 |
| | | | | | | |
| 3/30-4/11 | LaRiviere Marsh | 3 | 3 | 2 | 2 | 9 |
| | | | | | | |
| 4/04-4/05 | Mowry Slough North | 8 | 3 | 0 | 3 | 19 |
| | | | | | | |

Clapper Rail High Tide Surveys:

Winter airboat surveys for California clapper rails were conducted during high tide events on November 23-24 (1999), December 20-23, and January 18-22 (2000). Surveys are conducted in marshes of the south bay to track annual changes in clapper rail numbers for each marsh and to develop a population estimate for south San Francisco Bay. This information is used to evaluate the success of current management and to focus future management efforts to benefit the clapper rail.

Most surveys conducted by refuge personnel utilize airboats to access marsh areas. Surveys are conducted in the winter, during the highest predicted tides. Bair Island and Corkscrew Slough are surveyed by airboat by California Department of Fish and Game personnel, using similar survey methods to those used by the Refuge. Palo Alto Baylands is surveyed by San Francisco Bay Bird Observatory personnel and volunteers from existing boardwalks and levees.

A summary of the 1999-2000 survey results is provided in Table 2. Tides were not favorable for all marshes this year, so several large marshes were not surveyed. Surveys are not conducted if tides do not inundate a large proportion of the vegetation because detection of clapper rails would be very difficult under those conditions and surveys would not be accurate.

Greco Island was not attempted this year due to poor tides. We attempted to survey Dumbarton Marsh and Laumeister Marsh, but could only survey a portion of these marshes due to poor survey conditions. No surveys were conducted north of the Dumbarton Bridge or south of Calaveras Point on the east side of the bay, or north of Belmont Slough or south of Mountain View Slough on the west side of the bay.

A total of 239 California clapper rails were counted in surveyed marshes. Due to the substantial proportion of marsh acreage which was not surveyed this year, an accurate Estimated Population of clapper rails was not calculated for the south San Francisco Bay. However, survey results for individual marshes can be compared to previous years numbers. A five year summary, from 1994-95 to 1998-99 is provided in Table 4 for comparison.

Surveys indicate that rail population trends in several east bay marshes are lower than in previous years, while numbers in west bay marshes appear more stable. An incomplete Dumbarton marsh survey documented 2 clapper rails in the eastern section, behind the PG&E boardwalk, and 30 rails in the surveyed section of the western section of the marsh, for a total of 32 rails. The 1998-99 survey, which covered approximately the same area, documented 35 rails. Since approximately 2/3 of the marsh was surveyed in each of these years, an estimate of rails in the entire marsh would be no more than 50. Complete surveys in conducted between 1996-97 and 1997-98 yielded between 76 and 91 rails, respectively. This data indicates that rail numbers have decreased substantially in Dumbarton Marsh within the past several years.

Mowry North surveys recorded 40 rails this year, down substantially from 90 rails counted in 1997-98(not conducted in Mowry North in 1998-99). This is the lowest count since 1991, when 23 rails were counted. A nearly complete survey of Mowry South Slough recorded 10 rails, down from 17 rails in 1998-99 and 30 rails in 1997-98. The Mowry South Bay section had only 1 rail this year, down from 6 in the 1997-98 and 1998-99 counts.

On the west side of the bay, 18 clapper rails were counted on Hooks Island, with only 70-80% coverage due to poor tides. This number is lower than 26 counted in 1998-99 and 46 counted in 1997-98. Rail numbers on Hooks Island have fluctuated throughout recent years, with 22-46 rails counted each year. Eight clapper rails were counted at the mouth of Charleston Slough this year, compared to 10 in 1998-99. Palo Alto Harbor had 14 rails this year, compared to 16 in 1997-98 (not surveyed in 1998-99). San Francisco Bay bird Observatory counted only 5 clapper rails in Palo Alto Baylands proper, but tides were very poor on survey day and only a small portion of the marsh was surveyed. This survey was conducted from existing boardwalks by volunteers.

Surveys at Faber Marsh, yielded 52 rails, down from a record of 67 rails in 1998-99. Laumeister Marsh, which typically has from 30-50 clapper rails, could not be completely surveyed this year, but a partial count of 24 was recorded. Greco Island, which has recently had 80-130 rails, was not surveyed this year.

Twenty-three clapper rails were recorded in the Bair Island/ Corkscrew Slough area, up from 13 in 1998-99. These numbers represent a large increase from any previous years on record, since between 0 and 7 clapper rails are normally seen in this area. Three of these rails were seen in Corkscrew Slough and 20 in the Outer Bair tidal area.

The first surveys of the 1999-2000 season were conducted in late November in the Redwood Shores/Bird Island area. Tidal conditions were poor during the Bird Island survey and only 2/3 of the survey was completed before the tide receded. Three clapper rails were counted. The small berm at the west end of Bird Island did not yield any rails.

Surveys along the Redwood Shores levee, between the mouth of Belmont Slough and the mouth of Bay Slough recorded one rail, down from 4 in 1998-99. The rail was on the old berms near the mouth of Belmont Slough. In addition, no rails were recorded in the Redwood Shores Marsh, along the Bayfront.

In Belmont Slough, five rails were documented again this year in nearly the same places as the five counted last year. One clapper rail was recorded on the south shore, just past the first big bend in the slough and four clapper rails were recorded on the small island in the middle of the channel.

c. Western Snowy Plover

Megan Marriott, Refuge Biologist lead a group of staff and volunteers in monitoring the year 2000 breeding population and nests of the Pacific Coast Western Snowy Plover (*Charadrius alexandrinus*) on the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) and on the Eden Landing Ecological Reserve (ELER). She also banded Snowy Plover chicks as part of the first Snowy Plover banding program on the Refuge. Plovers made 27 nests on the Refuge, 18 (67%) of which were successful and two (7%) of which were predated. Plovers made 41 nests on the ELER, 20 (49%) of which were successful, and 13 (32%) of which were predated. Nests surrounded by topped predator enclosures were predated this year for the first time, on both the Refuge and ELER. Nest numbers were approximately 40% lower on the Refuge and 75% higher on ELER than in 1999. This dramatic shift in nesting concentration is likely due to a reduction of suitable levee nesting habitat on the Refuge since 1999. Fledgling success was not estimated for 2000.

For more information on the snowy plover monitoring program and results, see Research and Investigations, D-5-d

d. Tadpool Shrimp

Survey of Vernal Pool Tadpool Shrimp on Warm Springs Seasonal Wetland Unit:

Refuge Biologist Joy Albertson lead the survey for tadpool shrimp (*Lepidurus packardi*) on the Refuge's Warm Springs Seasonal Wetland Unit. The endangered tadpole shrimp (*Lepidurus packardi*), a species endemic to California, is generally found in the Central Valley with locations south in Tulare County, to the north in Shasta County, and to the east in Merced County. The Warm Springs Seasonal Wetland Unit (Warm Springs), a parcel of the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) in Alameda County, supports one of only two known populations found outside the Central Valley.

Adapted to surviving in ephemeral pools, the tadpole shrimp's short life cycle commences after the onset of the winter rains. As the soils saturate and the pools fill with water, cysts from the previous wet season hatch, and in as little as three weeks, the resulting shrimp reach sexually maturity.

The Refuge is conducting surveys in vernal pools on Warm Springs to document the presence and abundance of tadpole shrimp in ponds, to gain a better understanding of the shrimp's life cycle throughout the season, and to collect hydrological data for each pond. This data will allow us to make informed management decisions to benefit the tadpole shrimp and other vernal pool dependant species.

Refuge biologists sampled for tadpole shrimp in the vernal pools of Warm Springs on a monthly basis to determine presence and relative abundance of shrimp in each pool. Sampling was conducted on 15 February, 15 March, and 20 April in 2000. During each sampling session, dip-netting was conducted in all ponds containing sufficient water to allow dip netting (3cm or deeper). Nine pools were sampled on 15 February, twenty-two pools on 15 March, and four pools on 20 April (Figure 1). Physical pool parameters including salinity, water temperature, and depth were also measured during each session.

Tadpole shrimp were found in three ponds in 2000. Shrimp were captured in Pond 4b on 15 February, then in Ponds A3 and 2a on 15 March (Table 1). Shrimp were not found in either of these three ponds during subsequent sampling. No shrimp were captured on 20 April, when only four ponds had sufficient water remaining for dip-netting and water temperatures were relatively high. Shrimp found in Pond 4b on 15 February were 6-7 mm long. On 15 March, shrimp in Pond A3 were 10 mm long and shrimp in Pond 2a were between 5mm and 25 mm long.

Pond depth was greatest in most ponds in March, when 22 ponds were more than three cm deep and able to be sampled. Between 15 March and 20 April, substantial evaporation occurred, resulting in the complete drying of all but four ponds (4a,4b,A1,2b). It should be noted that ponds in the "4- complex" (4a,4b,4c,4d) are partly fed by an old capped well, which is leaking fresh ground water. Ponding occurs in the 4-complex ponds earlier in the season and for a longer

time period than in the other ponds on Warm Springs, especially in pond 4b, which contains the old capped well structure.

Water temperature in February was fairly similar in all ponds (between 13.3 and 17.2°C). In March, water temperatures in most ponds less than 30 cm deep were between 20 to 23°C, but in ponds greater than 30 cm deep, water temperatures were 14.4-15.5°C. The only exception to this trend was the Onorato Ponds* 1, 2, and 3, which were 20, 25, and 28 cm deep and 13.3, 14.4, and 13.3°C respectively. In April, pond temperatures in the four remaining ponds, which were between 3 and 19 cm deep, were between 24 and 29 °C.

Water salinity was between 0 and 1 ppt. in all ponds sampled during all sampling days, except Onorato Ponds* 1, 2, and 3. Salinities in these ponds were 5, 4, and 9 ppt. on 15 March, the only date these ponds were sampled.

**It should be noted that the Onorato Ponds are fed partly by saltwater from a channel off Coyote Creek, which follows the railroad grade and emerges at the southern tip of Warm Springs.*

The results from 2000 tadpole shrimp surveys at Warm Springs were very different from those in 1999. The number of shrimp caught per dip-net sweep (shrimp/sweep) in 1999 was 0.16, substantially higher than the 0.03 shrimp/sweep caught in 2000. Tadpole shrimp were found in only three ponds in 2000, compared to 10 ponds in 1999. Furthermore, since shrimp were detected on one sampling date in each of these three ponds, but were not detected during subsequent sampling one month later in the same ponds, it is likely that few shrimp survived long enough to reproduce. In fact, only one of the ponds in which shrimp were detected (Pond 4b) had water in it the following month. In contrast, several ponds sampled in 1999 supported shrimp for over two months, compared to less than one month in 2000.

The short period of ponding in the 2000 season was a result of the delayed, abbreviated rainy season. Substantial rain did not fall until February, when the majority of the precipitation occurred. After February, there were short periods of rainfall interspersed between long periods of dry warm weather. As a result, pond water levels decreased rapidly and pond temperatures increased.

The overall conclusion to be reached from this data is that 2000 was probably not a very productive year for tadpole shrimp at Warm Springs. Next year, sampling in the ponds should begin within two weeks of ponding to enable detection of the first hatched tadpole shrimp, and should be conducted monthly until pond water levels are too low to sample. Future pond sampling should include recording pH, salinity, temperature, and depth at each sampling session. This data will be used to better manage for tadpole shrimp in the future.

3. Waterfowl

As with other areas of the United States and Canada, the Winter Waterfowl Survey of the San Francisco Bay Area was again conducted by Refuge Staff. The Survey was done by fixed aircraft over three days: January 3, 4 & 5th. Over 250,000 waterfowl were counted which is slightly above the 1984-1990 average of 220,980. San Francisco Bay including the National Wildlife Refuges continues to be a major wintering area in the Pacific Flyway for waterfowl and the most important wintering area for Pacific Flyway populations of canvasbacks. This year over 21,000 canvasbacks were counted which is significantly above the 1990-1999 midwinter inventory average of 13,828.

On January 3rd, the Outer Coast of Marin and Sonoma Counties were flown including Tomales Bay, Bodega Bay, Drake's Estero and Abbott's, Bolinas and Rodeo Lagoon. The aircraft flew for 3.6 hours covering 100 miles. 44,666 waterfowl were counted with the majority counted in Tomales Bay (20,975) and Drakes Estero (10,405). The most common ducks were Scaup (15,983) and Wigeon (7,085). The most common geese were Brant (1,224).

On January 4th, the Suisun Bay of Contra Costa and Sonoma Counties was flown, including Grizzly and Honker Bays. The aircraft flew for 1 hour covering 70 miles. 36,100 waterfowl were counted. The most common ducks were Scaup (28,130), and Canvasback (3,137). No geese were counted.

On January 4th & 5th, the San Francisco Bay of Alameda, Contra Costa, Marin, Napa, Solano, San Mateo and Santa Clara Counties were flown. The aircraft flew for 7.5 hours covering 650 miles. 169,970 waterfowl were counted. The count was probably less due to exclusion from San Francisco Airport airspace. The most common ducks were Scaup (69,557), Scoters (30,083) and Shoveler (24,211). 20 Brant were counted.

5. Shorebirds, Gulls, Terns, and Allied Species

COMMON MURRE RESTORATION PROJECT: 2000

As a result of the 1986 *Apex Houston* oil spill off the central California coast, approximately 9,900 seabirds died, of which 6,300 were Common Murres (*Uria aalge*). A settlement, in August 1994, of litigation over the spill included funding for use in restoring injuries to natural resources resulting from the spill. To oversee the implementation of restoration actions a trustee council, comprised of representatives from the U.S. Fish and Wildlife Service, California Department of Fish and Game, and National Oceanic and Atmospheric Administration was established. Three restoration projects have been approved to date: 1) the Common Murre Restoration Project; 2) the Marbled Murrelet (*Brachyramphus marmoratus*) Nesting Habitat Acquisition Project, and; 3) Island habitat restoration activities at Southeast Farallon Island (Farallon National Wildlife Refuge).

The San Francisco Bay National Wildlife Refuge Complex was selected by the Trustee Council to lead the Common Murre Restoration Project. Soon after the preparation of a publicly reviewed restoration plan, the Refuge created the scientific and environmental education programs which constitute the Common Murre Restoration Project. Field data collection and analysis for the scientific aspect of the project is being conducted by biologists from the Refuge in collaboration with Humboldt State University and National Audubon Society. Further support has been provided by U.S. Fish and Wildlife Service (Sacramento Fish and Wildlife Office), U.S. Geological Survey (Western Ecological Research Center), National Park Service (Point Reyes National Seashore), Gulf of the Farallons and Monterey Bay National Marine Sanctuaries, California Department of Fish and Game, California Department of Parks and Recreation, and Point Reyes Bird Observatory. The Refuge is also playing the lead role in the implementation of the environmental education program. This following summarizes the results for year five (Federal Fiscal Year 2000) of the scientific and environmental education programs which make-up the Common Murre Restoration Project.

Efforts to restore the Common Murre colonies at Devil's Slide and San Pedro rocks continued in 2000 with the deployment of social attraction equipment in January and April respectively for each rock. The social attraction equipment deployed included: adult, chick, and egg decoys; mirror boxes; and sound systems. The decoys were removed to be cleaned and sound systems were turned off after the murres left the rocks in the fall, although at San Pedro Rock the adult decoys were left on the rock since they were relatively clean of bird guano.

Besides the social attraction work, various parameters associated with Common Murre breeding and population ecology were monitored at Devil's Slide and San Pedro rocks, the headlands of the Point Reyes National Seashore, and at the Castle/Hurricane Colony Complex along the Big Sur Coast. Parameters monitored included: colony and subcolony populations, reproductive success, adult time budgets, breeding phenology, attendance patterns, and chick diet. In addition, anthropogenic factors (e.g., boat disturbance, aircraft overflights, and oiling) and natural factors (e.g., predation and disturbance) that may adversely affect the success of recolonization efforts were monitored. The information collected will be used to help evaluate and refine restoration efforts at Devil's Slide and San Pedro rocks and other colonies in central California where social attraction techniques may be deployed in the future. Furthermore, this information will help us gain a better understanding of Common Murre breeding and population biology in central California.

Efforts of the Scientific Program resulted in 98 pairs of murres nesting and 75 chicks successfully fledgling from Devil's Slide Rock in 2000. These numbers represent an increase of 28 nesting pairs and 16 fledged chicks over the 1999 breeding season. Although a small number of murres attended San Pedro Rock this year no breeding occurred. It may be that nesting Common Ravens (*Corvus corax*) on San Pedro Rock are affecting attendance by Common Murres. Options for addressing this issue are being explored.

The Environmental Education Program continued for a fifth year in 2000. The program focused on teaching students about: 1) the natural history of Common Murres; 2) the detrimental impacts humans have had on central California murres from the 1800's to the present; 3) efforts to restore Common Murres in central California, and; 4) ways students can help restore and protect seabirds. The project also provided students with the opportunity to participate in the restoration project at Devil's Slide Rock by repainting the murre decoys before their re- deployment. Over 730 students from eight schools learned about seabird conservation as a result of these outreach efforts.

COLONIAL WATERBIRD SUMMARY, 2000 BY SAN FRANCISCO BAY BIRD OBSERVATORY:

As part of SFBBO's Birds of the Baylands Program, staff biologists and volunteers monitored 30 active waterbird nesting sites in south San Francisco Bay and outlying areas during the 2000 nesting season. We focused on nesting effort at colonies of California Gull, Forster's Tern, Caspian Tern, Black Skimmer, Great Blue Heron, Great Egret, Snowy Egret, Black-crowned Night Heron and Double-crested Cormorant. We also noted nesting activity of loosely colonial shorebird nesters, American Avocet and Black-necked Stilt. Trained volunteers monitored colonies using binoculars and scopes during 5 sequenced 4-day periods during the season, counting adults and when possible, nests. Staff biologists walked through selected gull and tern colonies to obtain precise nest and clutch counts. Nearly all larid colonies were found on salt pond islands, and degraded and inboard salt pond levees. We did not see any signs of predation by red fox.

The number of breeding California Gulls has been steadily increasing since the establishment of 12 nests at the A6 salt pond colony in Alviso in 1980. This year, this species bred at 6 sites, with a total of 7,429 nests, nearly all on refuge property. The A6 colony continued to be the largest, with 5,534 nests. Satellite colonies continued on A9/A10 levee (993 nests), M1/M2 levee (684 nests), and B2 islands (206 nests). We also observed four nests at Brooks Island near Richmond, and eight at the Alameda Naval Air Station.

Forster's Terns nested at nine south bay sites with a peak total nest count of 1603 nests, half (802) of which were on refuge property. Eight of these colonies were located on salt pond islands; one was located in a diked pickleweed marsh near Belmont Slough in San Mateo Co. The traditional colony at Coyote Hills, Alameda Co. failed to establish, probably due to high water levels inundating the islands early in the season.

Caspian Terns nested at four bayside sites, with a peak nest count of 807 nests, however 603 were counted just at Brooks Island. The remaining 204 nests were on south bay salt pond islands: Pond A7 (118 nests), Baumberg 10 (79 nests), B2 (6 nests), Ravenswood (1 nest). Only the last two are on refuge property, in association with Forster's Tern colonies.

Black Skimmer, a recent immigrant to the south bay, continued to nest in small numbers, in association with tern colonies. Four single nests were observed at the Hayward Shoreline area

and three Refuge ponds: N3, A16 and R1. Skimmers tend to be slower to initiate than terns, and all four nests are believed to have eventually failed.

We detected herons and egrets nesting at five bayside locations and eight inland colonies in the four south bay counties. Nesting sites include power towers, trees, *Scirpus* marshes and abandoned structures in salt ponds. For the second year in a row, the traditional large mixed heronry at Mallard Slough failed to establish for unknown reasons. A much smaller mixed colony was observed at the Coyote Creek Lagoon, in the *Scirpus* border. It consisted of Great Egrets (14 nests), Snowy Egrets (114 nests) and Black-crowned Night Herons (at least 20 nests, possibly more of this secretive species). Total adults observed in all south bay colonies were Great Blue Heron (114), Great Egret (112), Snowy Egret (112), and Black-crowned Night Heron (92).

Double-crested Cormorants nested in power towers at Bair Island again this year (total of 262 nests on 3 towers), but for the first time were also found nesting on a levee in Alviso (A9/A10) among California Gulls (18 nests). Breeding adults were observed foraging for fish in nearby ponds.

American Avocets and Black-necked Stilts have adapted to salt pond habitats for both breeding and foraging. Avocet nests are often found on islands among Forster's Terns, while stilts generally, but not always, prefer diked pickleweed marshes. We noted breeding avocet pairs at seven salt pond island sites (434 nests) and stilts at three island sites (51 nests).

9. Marine Mammals

The Refuge continued to be an important area of protection for harbor seals (*Phoca vitulina richardsi*). The Refuge has a number of haul out and pupping sites including the largest site at Mowry Slough and secondary sites (less than 40 individuals) at Guadalupe Slough near its junction with Coyote Creek, Greco Island, and Corkscrew Slough in Bair Island.

Mowry Slough is considered the primary pupping site for harbor seals in the South Bay. Extensive rookeries in the Mowry area were reported as early as 1928. The seal population at Mowry fluctuates seasonally, with highest numbers seen during the pupping season, in April and May. A 1995 study demonstrated that between 44% and 65% of all pups observed in San Francisco Bay were recorded at Mowry Slough.

The number of seal pups is twice that of the other major San Francisco Bay pupping site, Castro Rocks. The San Francisco State University Richmond Bridge Harbor Seal survey estimates that 35 mother/pup pairs used Castro Rocks in 1999 and 40 in 2000. Numbers of mother/pup pairs at Mowry Slough are higher; a maximum of 78 pups were onsite in 1999 and 90 in 2000.

Seals at Mowry Slough appear to be subject to few disturbances from humans, due to the remoteness of the haul out site. Boat traffic is prohibited within Mowry Slough during the

pupping season. The only disturbance in the area is due to limited duck hunting in the fall and winter and periodic work on the Cargill levees.

The Alviso Slough seals are subject to light disturbance by visitors using the Alviso Slough trail out of the Alviso Marina trailhead and infrequent boats using of Alviso Slough. The Greco Island seals are infrequently disturbed by boaters using Redwood Creek and Westpoint Slough. The seals at Corkscrew Slough are subject to daily disturbance by small motor boats, canoes, kayaks and the Stanford Crew boats based in the Port of Redwood City. These seals seem less sensitive to human disturbance than other sites around the bay.

15. Animal Control

The Refuge's approved Predator Management Program continued this year. The main objective is to protect the endangered California clapper rail from mammalian predators. Predator removal was conducted by one Wildlife Biologist and two Wildlife Specialists from USDA Wildlife Services. Control methods consisted of cage traps, padded leghold traps, calling, and spotlight/shooting.

Predator management activities were conducted at the following Refuge locations: San Francisco Bay National Wildlife Refuge's Complex Headquarters, Bair Islands, Warm Springs, Coyote Lagoon, Alviso Cannery, Mayhews Landing, Mowry North & South, Knapp, Munster; Ideal Marsh, Environmental Education Center, and Drawbridge. Off the Refuge, activities were conducted at the following locations: California Fish & Games' Baumberg North and South; Tri-City Landfill; Hickory; Moffett (A-3W, A2E, B2); Moffett Field, Palo Alto Golf Course, Athletic Center, Airport, Baylands, Flood Basin, and Dump; Faber/Laumeister, Redwood City Plant; Redwood Shores; Menlo Sewage Plant; Newby Island Dump; and Salt Pond A-18.

This year 31 red fox, 277 feral cats, 107 raccoons and 346 striped skunks were removed.

17. Disease Prevention and Control

Botulism outbreaks have been recorded in the South Bay in the past. The outbreaks have been aggravated by the discharge of sewage effluent into Mallard Slough and Coyote Creek. The area is monitored by members of the San Francisco Bay Bird Observatory under contract with the local dischargers. Fortunately, in 2000, botulism was not a problem; few dead birds were found.

H. PUBLIC USE

1. General Public Use

Don Edwards San Francisco Bay National Wildlife Refuge serves a dense, local population of 7 million people. It is an ideal place for Bay area urbanites to visit a relatively unspoiled area, enjoy the local wildlife and learn about nature, conservation and wildlife management.

The Visitor Services Division is composed of two sub-divisions. The Environmental Education Program teaches conservation and wildlife values to children and the adults that accompany groups on field trips to the Refuge. The Interpretation and Outreach Program explains natural history and salt marsh ecology to families and other audiences on and off the Refuge through a wide variety of media. Both programs generate public recognition of the National Wildlife Refuge System.

The Interpretation and Outreach Program includes Refuge signage responsibilities, development of exhibits, construction of visitor facilities, writing of brochures and other publications, administration of an active volunteer program, and advancement of general community relations and involvement.

During 2000, 362,251 people visited the Refuge. Over 23,800 people stopped in at the Visitor Center or the Environmental Education Center, and 2,114 attended interpretive programs, special events, and other events. Students, teachers, and other adult leaders who attended environmental education activities at the Environmental Education Center in Alviso or the Visitor Center in Fremont numbered 9,195. Over 150,000 visitors received our self-guided interpretive messages when they read our wayside exhibits.

The Visitor Center in Fremont was closed on Mondays and all Federal holidays. Otherwise, it remained open from 10:00am to 5:00pm. The trails and fishing pier were open from 7am-8pm from April 1-September 30, and from 7am-6pm from October 1-March 31. Trails and the fishing pier were open every day except New Year's Day, Thanksgiving and Christmas.

The weekend operations and interpretive programs at the Environmental Education Center were funded by grants from the Santa Clara County Urban Runoff Pollution Prevention Program and the City of San Jose Environmental Services Department. The Interpretive Specialist and Education Specialist funded by these municipalities are employees of the San Francisco Bay Wildlife Society, which manages the grants. At the EEC 1,199 people attended interpretive programs and special events. Over 920 people attended programs conducted off-site. The Environmental Education Center is open and staffed from 10am to 5pm on Saturdays and Sundays. A total of 5,195 people visited the Center in calendar year 2000, in addition to those participating in environmental education activities.

Most of our visitors participated in recreational activities other than formal programs at one of the two centers. The public fishing area (3,500 users), trails (350,437 users including bikers and joggers), sloughs (3,900 duck hunters in boats and 195 wildlife oriented recreational boaters), and other public areas were used by 204,219 visitors.

2. Field Trips (Outdoor Classrooms) Students

Overview

The Refuge conducts Environmental Education programs at both the Environmental Education Center in Alviso and the Newark Slough Learning Center in Fremont. All Environmental Education programs are guided by an Environmental Education Plan, which provides a direction for the Program and ensures implementation of the Plan's components as time and staff availability allows. The Plan is updated in the spring and fall of each year.

In 2000, the Refuge offered three types of field trip programs for students: the Wetland Round-Up (K-6 grades), Trekking the Refuge (3-6 grades), and Slow the Flow (5-12 grades) field trips. The field trip format allows small groups of students to rotate from one learning station to the next throughout the day. As a result, students and accompanying adults spend an entire school day learning about the importance of the resource management objectives of the Refuge: preserving and protecting significant wildlife habitat in the South Bay, protecting threatened and endangered species, and protecting migratory birds. Hands-on field trip activities, such as searching the mud for worms or collecting water samples from the slough, are especially popular with students and teachers.

Before bringing a group to one of our field trip programs, the educators and one other adult must attend a 4 (for Wetland Round-Up and Trekking the Refuge) to 5 ½ (for Slow the Flow) hour field trip orientation workshop. Other adults from the group are also encouraged to attend these workshops. Upon completion of a field trip orientation workshop, an educator has all the necessary tools to plan and conduct an exciting field trip.

Educators recruit volunteers (usually students' parents) to assist with the field trip. A high adult to student ratio (2 adults to every 10 students) is required. This ratio allows one set of adults to be learning station leaders and the other set to be chaperones who assist station leaders and rotate students from station to station. The learning experience is enhanced by the small group setting, and students are taught more effectively because their questions and comments can be addressed individually.

With only one Fish and Wildlife Service Environmental Education Specialist stationed at the Visitor Center and only one at the Environmental Education Center, the high quality of the field trip programs and the number of students served would not be possible without the help of Student Conservation Association interns and a few dedicated volunteers.

The interns and volunteers learn the basics of the Wetland Round-Up field trip program and lead the first rotation of a particular activity for each field trip. In addition, they conduct opening and closing presentations, and provide support to educators and parent leaders by answering any questions they have about conducting activities at the learning stations. When not busy with visiting school groups, the interns and some volunteers help the staff with special projects, such as designing activity props, writing closing activities, conducting pre-field trip slide show presentations, and developing new field trip activities, which enhance the educational experience for the students.

All Environmental Education Programs have been designed to teach the importance of the Refuge's resource management objectives. Educators and parents learn about these objectives when they attend a field trip orientation workshop. Every activity that is developed for students relates to the Refuge's resource management objectives and a specific resource management issue, states what the Refuge staff is doing to resolve the issue, and gives ideas of what students can do to help the staff resolve the issue.

Field Trip Programs

Wetland Round-Up

A Wetland Round-Up field trip begins with an opening activity for the students conducted by a volunteer (usually a Student Conservation Association intern). While the opening activity takes place, a staff person talks to the parents about the field trip schedule and the location of the activities. The students then divide into small groups (up to 12 students) and begin activities at different learning stations, rotating from station to station during the course of the day. About half of the adults are the small group chaperones, each moving with his/her group to the different stations. The other adults teach an activity at a learning station, repeating the activity for each group during the field trip day. The educator acts as a "floater," available to help parent leaders with their learning station activities, answer field trip logistic questions and take care of any student emergencies. A closing activity at the field trip's conclusion summarizes topics and ties together any loose ends to make the day's visit more memorable for the children. The Wetland Round-Up field trip program is offered at both the Environmental Education Center in Alviso and the Visitor Center in Fremont.

The Wetland Round-Up field trip requires the help of a staff person and volunteer in conducting the field trip opening and closing activities, showing the adult leaders and chaperones the locations of the learning station activities, demonstrating the first rotation of an activity, and overseeing the flow of the field trip with the educator in charge. The educators select their own field trip activities and classroom activities from the *Salt Marsh Manual, an Educator's Guide*. Educators also determine the time schedule of the field trip, adapting the number and length of activities to the amount of time they have available for their field trip. A typical field trip has six learning stations (hands-on, environmental education activities are conducted at these stations) and the group consists of two educators, sixty-five students, and twelve to fourteen parents (six learning station leaders, and six to eight chaperones).

Wetland Round-Up Sample Schedule

- 9:00 Bus arrives at the refuge
- 9:15 - 9:45 Habitat slide show or the Salty and Cali Puppet Show- opening with students conducted by staff or intern
- Adult orientation - conducted by staff or intern
- 9:45 - 10:15 Station #1 (Mud Studies) - conducted by school volunteer
- 10:15 - 10:45 Station #2 (Beaks & Feet) - conducted by school volunteer
- 10:45 - 11:15 Station #3 (Where Have All The Wetlands Gone?) -conducted by school volunteer
- 11:15 - 11:45 Station #4 (Wetlands Water Café) - conducted by school volunteer
- 11:45 - 12:10 Lunch
- 12:10 - 12:40 Station #5 (Salinity Testing) - conducted by school volunteer
- 12:40 - 1:10 Station #6 (Salt Marsh Mini- Expedition) - conducted by school volunteer
- 1:10 - 1:30 Super Citizen - closing with students conducted by staff or intern
- Clean-up by adults
- 1:30 Departure

Trekking the Refuge

For Trekking The Refuge field trips, one staff person places 4 day packs filled with investigative equipment on the back deck of the Visitor Center building. These day packs contain all of the needed equipment for the field trip. The teacher and adult leaders pick up the packs at the beginning of their field trip, and at the end of the day, they clean and count the equipment and return it to the back deck. Trekking the Refuge takes place on the Tidelands Trail, a 1-mile loop which leads students through the many different habitats at the refuge, where they answer observation questions and engage in hands-on activities. A classroom activity packet, checked out from our lending library, is mailed to the teacher two weeks before the field trip. It contains a slide show, color transparencies, a video, laminated posters, and laminated plant and animal pictures designed to complement the Trekking the Refuge guide. Teachers may keep this packet for up to two weeks after their field trip.

The Trekking The Refuge field trip differs from the Wetland Round-Up field trip in the amount of staff time needed and number of students allowed on each trip. A maximum of 36 students (one class size) is allowed on each Trekking the Refuge field trip. This policy limits the impact on the habitats. Trekking the Refuge field trips are also run entirely by educators and volunteer leaders. Educators lead the opening and closing activities with the entire class, and lead the class on a 45 -minute trail walk guided by observation questions to be answered on a data sheet. Educators recruit 2 to 3 adult volunteers to lead three pre-selected, activity learning stations, and 2 to 3 adult volunteers to act as chaperones. Since refuge staff do not lead activities for this field trip, Trekking the Refuge and Wetland Round-Up field trips can occur simultaneously. Trekking the Refuge is only offered at the Visitor Center in Fremont. It is designed for grades 3-6.

Trekking the Refuge Sample Schedule

- 9:00 Bus arrives at the refuge
- 9:15 - 9:30 Bathroom Break for students, 3 adults pick up and count equipment
- 9:30 - 9:50 The Bay Begins at Your Front Door Opening Discussion
 - conducted by educator
- 9:50 - 10:40 Trail Trekkers (whole group hike) - conducted by educator
- 10:40 - 11:10 Station #1 (Salt Marsh Safari) - conducted by school volunteer
- 11:10 - 11:40 Station #2 (Salt Pond Private Eye) - conducted by school volunteer
- 11:40 - 12:10 Lunch
- 12:10 - 12:40 Station #3 (Salt Marsh Safari) - conducted by school volunteer
- 12:40 - 1:10 Salty's Search for a Habitat - Closing Activity conducted by educator; adult
 volunteers return and clean equipment
- 1:15 Departure

Slow the Flow

This field trip program allows students to explore the concepts of water use, wastewater treatment and habitat preservation, with the end goal of increasing water conservation awareness. It begins with a tour of the San Jose/Santa Clara Water Pollution Control Plant. The tour is given by a guide trained through the Plant, and students learn what happens to their water after it goes down the drain. After the Plant tour, students come to the Environmental Education Center, where they eat lunch and the Slow the Flow coordinator welcomes the teachers, parents, and students to the Refuge. The trained teacher from the school leads the beginning activity, which

focuses on the different paths water can take (both indoors and outside). The students are then split into two groups, one led by the Refuge Environmental Education Specialist and the other led by the school's teacher. The students participate in an ecosystem exploration, where they learn about Refuge habitats and collect water samples from the habitats. Students then test the water for different salinity levels to determine if the Water Pollution Control Plant's freshwater effluent is changing the salinity levels in the Refuge's Artesian Slough. A closing question and answer session is led by EEC staff, allowing students to review what they have learned.

The Slow the Flow field trip to the Refuge is offered for up to a maximum of 35 students. It is in its second year of operation and is offered exclusively at the Environmental Education Center, for 5th - 12th grade students in San Jose, Milpitas, Monte Sereno, Saratoga, Cupertino, Los Gatos, and Santa Clara. The program is funded by the City of San Jose and is offered in cooperation with the San Francisco Bay Wildlife Society and the Refuge. Offering the program to middle and high school students allows the Refuge to expand its audience base from K-6 to K-12.

Slow the Flow Sample Schedule

| | |
|-------------|---|
| 9:00 am | Board bus at school |
| 9:30 | Arrive at San Jose/Santa Clara Water Pollution Control Plant |
| 9:40-9:55 | Orientation and discussion at model with Plant tour facilitator |
| 10:00-10:45 | Tour (driving in bus with off-stops and discussion) |
| 10:45-10:55 | Board bus and drive to Environmental Education Center (EEC) |
| 11:00-11:25 | Arrive at EEC Lunch in the EEC pavilion, with all students |
| 11:30-11:45 | Introduction and <i>Wastewater Pathways</i> opening activity (Intro by EEC staff; <i>Pathways</i> by trained educator) |
| 11:45-12:25 | Ecosystem Exploration with water sample collection (Led by EEC staff and educator) |
| 12:25-1:10 | Salinity Sleuths (Led by EEC staff and educator) |
| 1:10-1:25 | Closing (Question and Answer) and Thank Yous (Led by EEC staff) Concurrent: Clean-up equipment & dispose of trash (Conducted by educator and Chaperones) |

1:25-1:30 pm Board bus and depart for school

Field Trip Reservations

Reservations for Wetland Round-Up and Trekking the Refuge field trips were taken twice during the year. On the first day of reservations, we took calls from 4:00 pm to 5:30 pm, to allow teachers time to get out of school and call us in the afternoon. Reservations for the Winter and Spring session, conducted February through July, began on the first Monday in December. Reservations for the Fall session, conducted October through December, began on the second Monday in September. Using this type of booking schedule, we had minimal field trip cancellations. Since the Slow the Flow program is so new, reservations were taken on a daily basis. Once the program becomes more established, a reservation system similar to Wetland Round-Up and Trekking the Refuge will be followed.

Field Trip Statistics

Environmental Education Center

Most of the groups using the EEC for a field trip participated in the Wetland Round-Up field trip program. 2,694 students, 122 teachers, 256 station leaders and 351 chaperones visited the site on this type of educator-led field trip.

Slow the Flow field trips at the EEC are staged out of the P.O.S.T. Learning Pavilion and take place in the same proximity as the Wetland Round-Up field trips. To minimize impact to the habitats and allow for the two field trip programs to run concurrently, a maximum of 35 students (one class) participate at a time. During the year 2000, 6 field trips were conducted at the Environmental Education Center, with 6 educators, 72 chaperons and 180 students participating. This program was in the piloting phase to evaluate the field trip activities and the field locations they share with the Wetland Round-Up field trip program. Slow the Flow has been well-received by educators.

The combined totals for usage by all education groups at the EEC for 2000 are as follows: 2874 students, 128 educators, and 679 educator-recruited volunteer leaders and chaperones.

Newark Slough Learning Center

A pavilion and an old, former pump house serve as the hub for the Wetland Round-Up Field Trip activities at the Newark Slough Learning Center. The pavilion, completed in 1992, is the location of the field trip opening and closing activities and some of the activity stations. In the past, there was a greater demand for the Wetland Round-Up field trip program than the staff was able to meet. Long waiting lists existed and many classes were turned away. Beginning in 1995, the Trekking the Refuge field trip program, which takes place on the Tidelands Trail and allows for double bookings, was fully implemented.

The Wetland Round-Up field trip program at the Newark Slough Learning Center in Fremont completed its fourteenth year at the end of 2000. One hundred and twenty eight classes, 3,297 students, 128 educators, and 601 volunteer leaders participated.

There were 26 Trekking the Refuge field trips in 2000, with 26 educators, 128 leaders, and 760 students participating.

Adding together the Wetland Round-Up field trips and Trekking the Refuge field trips gives us a grand total of 4,057 students, 154 teachers and 729 school volunteers participating in educator-led field trips at the Newark Slough Learning Center.

Summary of Statistics

Adding the totals from the table below, 8,621 people were served by the Refuge field trip programs in 2000. In addition, 221 people visited the Refuge and conducted their own environmental education field trips, without involvement from our staff. Visits from local college classes are an example of these non-Refuge conducted field trips.

Field Trip Program Participation, 2000

| | Students | Teachers | Teacher-recruited Volunteers |
|---|-----------------|-----------------|---|
| Wetland Round-Up, Visitor Center | 3297 | 128 | 601 |
| Wetland Round-Up, Environmental Education Center | 2694 | 122 | 607 |
| Trekking the Refuge, Visitor Center | 760 | 26 | 128 |
| Slow the Flow, Environmental Education Center | 180 | 6 | 72 |
| TOTALS | 6931 | 282 | 1408 |

Outreach Presentations

Slow the Flow

To allow the message to reach teachers and students unable to come to the Water Pollution Control Plant and Refuge for a field trip, the Slow the Flow program offered classroom

presentations for grades 5-12 in San Jose, Santa Clara, Monte Sereno, Saratoga, Cupertino, Los Gatos, and Milpitas. The classroom presentations included a slide show of Refuge habitats followed by hands-on salinity testing with samples previously collected from the different Refuge habitats. These outreach presentations are a great way to bring the message of water conservation to many students in one day.

Classroom Presentations: Slow the Flow

Teachers

12

Students

550

Common Murre Restoration Education Program

Since 1996, seabird biologists have been trying to restore a common murre colony to Devil's Slide Rock along the Central California Coast. In 1997, the project was expanded to include San Pedro Rock, which is directly north of Devil's Slide Rock. The restoration project is funded by a natural resource damage settlement resulting from oil spilled by the Apex Houston barge in 1986. U.S. Fish and Wildlife Service biologists from San Francisco Bay NWR Complex, with scientists from the National Audubon Society, Humboldt State University Foundation, and the U.S. Geological Survey are using murre decoys, three-sided mirror boxes, and a CD player that projects amplified murre calls to attract the birds and make the rock appear to be a thriving murre colony.

In 1996, a Seabird Restoration Education Program was approved and budgeted by the Apex Houston Trustee Council, made up of representatives from the Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and California Department of Fish and Game. The program allows kindergarten through sixth grade students to learn about seabirds and actively participate in the restoration of the common murre colony. This outreach program completed its fifth year in 2000 and involved 637 students, 22 teachers, and 9 schools in Pacifica, Montara, Half Moon Bay, Fremont, and San Jose. It is coordinated by Refuge Environmental Educators Genie Moore and Fran McTamaney.

During 2000, the program began with classroom presentations conducted by an Environmental Education Assistant for the Seabird Project and three Refuge volunteers. Students were introduced to seabird biology, food chains in the ocean, and the negative effects that humans have on seabirds. The students were shown mirror boxes, decoys, and pictures of the biologists on Devil's Slide Rock and San Pedro Rock.

The students were then introduced to their own role in the common murre restoration project. In previous years, all participating students painted decoys to be placed out on the rock. However, in order to make room for the increasing colony size, the biologists have decreased the number of decoys that they place out on Devil's Slide Rock. As a result, not all students were able to paint decoys this year. However, since this project has become an integral part of the teachers' curriculum, we have continued to conduct classroom presentations for all of the twenty-two classes. In October, 3rd and 4th grade students were given the opportunity to repaint the decoys that the biologists had removed from the rock. The decoys were in need of repainting, a perfect

project for the students. They took the repainting very seriously and have demonstrated a strong tie to the restoration project, anxiously waiting for the decoys to be placed back on the rock in December. Since there were only 300 decoys for the students to paint, the remainder of the classes, 5th grade students, made paper mache Common Murre egg decoys. This was a very successful addition to the project. Classes will be kept updated on the number of murre visiting the rock through the school year through *The Murre Maniac Newsletter*.

The excitement of connecting teachers, students, parents, biologists, and environmental educators has truly made the Seabird Restoration Education Program successful. The education program will be repeated each year, until the goal of reestablishing a murre colony is reached, an achievement in which the students can truly take pride.

Classroom Presentations: Seabird Restoration Education Program

Teachers

22

Students

637

Summer Day Camps

Day camps for local children were conducted during the months of July and August at the Environmental Education Center, Newark Slough Learning Center, and for the first time, at Edison McNair Academy in East Palo Alto. The three summer camps were funded from three grants through the San Francisco Bay Wildlife Society. The grants were from the Sierra Club Youth In Wilderness Project, Northern California Grantmakers, and a private donation. Thanks to the grants, the Refuge was able to offer the camps free of charge. The environmental education specialists and interns cooperatively designed, planned and conducted the Marsh-In camp at the Environmental Education Center, the Junior Naturalist camp at the Newark Slough Learning Center, and the Salt Marsh Safari camp in East Palo Alto. The interns also assisted by adapting activities, making props, and setting up equipment. The interns, along with several volunteer leaders, enthusiastically led the campers through a variety of activities that included simulation games, guided imageries, wildlife observations, art projects, and share circles. A combination of large and small group activities were conducted.

The overall theme of the summer camps was "Wildlife Refuge's in Our Backyard: Learning About Wetlands In Our Community." During the five days of camp, students learned what a watershed is and how it connects their neighborhoods to creeks, salt marshes, sloughs, mud flats and the Bay. Each day consisted of a variety of arts and crafts, simulation games, hikes, and explorations of the salt marsh, slough, mudflats, salt ponds, creeks, and uplands that are part of the greater community.

Marsh-In Day Camp, 2000

The nineteenth annual Marsh-In Summer Day Camp was held for one week in the middle of August at the Environmental Education Center. This summer program originated in 1981 with the intent of building rapport with the children living in the local community of Alviso. To help

promote the camp, the environmental education interns presented a twenty-minute skit to 155 children who were attending summer school in the neighborhood. The effort was a success, and the camp was attended by a total of thirty-two children entering grades 1-6.

The Santa Clara Basin Watershed was the theme of this year's camp. Whole group activities were designed to be appropriate for children of all ages. Small group activities were designed for either older or younger children, and conducted independently. Activities were led by three interns, four Refuge volunteers, the grant-funded Interpretive and Education Specialists, and the on-site Fish and Wildlife Service Education Specialist. The combination of enthusiasm and moderate leader-to-camper ratio allowed the campers to enjoy an exciting and memorable experience.

The five-day program included an overnight session (younger students did not participate in the overnight session). As a result of the summer camp program, the children living in Alviso increased their awareness of the many factors that impact the habitats of the Refuge and gained a greater sense of stewardship for the Refuge at the Environmental Education Center.

Junior Naturalists, 2000

Junior Naturalist Camp, conducted at the Newark Slough Learning Center, provides children in the East Bay an opportunity to learn more about nature and the outdoors at the Refuge. This summer camp was advertised at local schools and libraries with flyers. Children applied by sending a letter stating the reasons they want to become Junior Naturalists. One week of camp was held in mid-July. The San Francisco Bay Watershed was the theme of this year's camp. A total of thirty-one students, entering grades 3rd -6th, from Fremont, Newark, and Union City attended camp this year. Whole group and small group activities were led by three interns, the Environmental Education Specialist, and four volunteers. Junior Naturalist Camp took place from 9:00 a.m. to 12:00 p.m. each day, except for Thursday, when it lasted from 9:00 a.m. to 3:00 p.m.. On Thursday we hiked 3 miles to Coyote Hills Regional Park. The week-long camp closed with a ceremony in which campers conducted skits for their families and were then awarded with certificates. We also held a potluck for the campers and their families to celebrate the end of a successful week of camp. The enthusiasm of the leaders contributed to the success of the camp, and campers learned about the local environment through positive outdoor experiences.

Salt Marsh Safari, 2000

This year we added a week of camp at Edison McNair Academy in East Palo Alto. East Palo Alto is an under-served, low income community on the west side of San Francisco Bay near the Dumbarton Bridge. East Palo Alto is adjacent to a portion of the expansive salt marshes of the Don Edwards San Francisco Bay National Wildlife Refuge. Unfortunately, the Refuge does not have a facility on this side of the Bay. As a result, we worked with the Ravenswood School District to find a school where we could conduct the 1-week summer camp. Each day we conducted arts and crafts activities, hikes, and simulation games to teach about the Bay's watershed and the habitats within the watershed. On three of the days we took field trips to the open space areas that surround East Palo Alto: we visited the salt marsh of the Refuge; we conducted a creek clean up with the organization Bay Area Action at San Francisquito Creek,

which flows through East Palo Alto; and we visited the Palo Alto Baylands Visitor Center where we conducted a mud and slough water lab and went for bird walks through the marsh. Twenty-five campers entering grades 3-6 attended Salt Marsh Safari this year. The majority of the campers had never before attended a summer day camp program, and by the end of the week they were asking that summer camp be extended! This was the first time that the Refuge has conducted a program in East Palo Alto, and it was well-received by the campers and the community alike. We consider this to be a great success and hope to continue the program in future years.

3. Environmental Education - Teachers

In the San Francisco Bay Area, where many environmental education facilities and programs are available, the Refuge Environmental Education Program is unique: we provide a facility where educators lead their own field trips. As in previous years, we conducted training for educators (teachers, youth leaders and outdoor recreation leaders) and learning station leaders (parents, aides, grandparents, etc.) interested in participating in the Refuge's educator-led field trip programs. Following the training and guidance we provide, educators plan their field trip, prepare the students and adult leaders and conduct the field trip. By having educators fully responsible and highly involved in their field trip, they are more likely to integrate the classroom curriculum with their field trip activities, providing students with a learning environment in which to discuss Refuge-related topics that extends beyond the time actually spent on the Refuge. As a result, students achieve a more memorable and in-depth experience.

For the past several years, Environmental Education Specialists at both sites have developed and maintained valuable relationships with several local schools. George Mayne Elementary, the local school in Alviso, annually conducts family science programs at the Environmental Education Center. At these programs, Sandy Spakoff, the Environmental Education Specialist and teachers from the school work together to conduct activities that are both educational and entertaining. Many classes from George Mayne School also come to the EEC on field trips.

Warwick Elementary School worked closely with Genie Moore, the EE specialist at the Newark Slough Learning Center, throughout the year. Teachers and parents attended workshops, and students came on field trips throughout the year.

Wetland Round-Up Field Trip Orientations and Planning

During a Wetland Round-Up field trip orientation, participants hear background information about the Refuge and learn how to lead the activities found in the *Salt Marsh Manual, an Educator's Guide*. The logistics of planning a field trip, as well as rules and regulations, are also addressed. By the end of the orientation, the educators and recruited volunteers understand that we are a resource management agency, the identity of our agency, and that each field trip activity is designed to meet the Refuge's resource management objectives. The staff is available for individual planning sessions should educators require assistance in planning their trips. A total of 13 Wetland Round-Up Orientation workshops were conducted at the Environmental Education Center in Alviso with 84 educators and 125 educator-recruited volunteer leaders participating. A

total of 10 orientations were held at the Newark Slough Learning Center in Fremont with 134 educators and volunteer leaders attending. The knowledge and confidence gained by orientation participants results in an exciting, well-organized field trip.

We continue to distribute the *Salt Marsh Manual, an Educator's Guide* free of charge to all educators and group leaders who participate in a Wetland Round-Up Field Trip Orientation Workshop. This curriculum guide was designed to facilitate discovery, learning, and enjoyment of field trips to the Don Edwards San Francisco Bay National Wildlife Refuge. In 1996, the guide was revised as the 4th edition and became two separate guides, one for each site, in order to focus more closely on the differences between the habitats. Each guide contains background information, area maps, planning and group management hints, classroom and on-site activities, and additional resource information. The additions to this revision include field trip openings and closings, an Outstanding Volunteer Award sample, field trip emergency procedures, a bay ecology learning assessment for educators, an activity for preparing students for the field trip, post-trip activities correlated to field trip activity sections on "Habitats, Bird Migration, Endangered Species and The Bay Begins At Your Front Door," and a chapter on "How Children Learn" that includes theme building, life skills, and learning theory. The design of the field trip activities was changed to a script format upon the suggestion of a parent leader. The "Read," "Ask," and "Do" format makes the field trip activities easier for the parent leaders to conduct. The activities in this guide are appropriate for grades K-6.

Trekking the Refuge Field Trip Orientations

During the field trip orientation workshops, educators and parents learn how to conduct pre-selected openings and closings, a trail walk or discovery walk, and three learning station activities. The logistics of planning a field trip, as well as background information, policies and rules, are also discussed during the workshops. By the end of the orientation, the educators and parents understand that we are a resource management agency, the identity of our agency, and that each field trip activity is designed to meet the Refuge's resource management objectives. After completing an orientation, educators receive the *Trekking The Refuge Educator's Guide*. Because Trekking the Refuge is an entirely educator-led field trip, the workshop is essential to the success of the field trip. In 2000, 8 orientations were held for 41 educators and volunteer leaders.

The *Trekking the Refuge Educator's Guide* includes:

- An introduction to the Refuge
- Background information on habitats, plants, and animals
- Pre-visit preparation hints
- Classroom activities with resource management objectives and issue information
- Field trip activities: opening and closing activities, a walk, and learning station activities.

A pre-visit packet with materials such as a slide show, color transparencies, a video, laminated posters, and laminated plant and animals pictures complements the Trekking the Refuge guide.

Slow the Flow Field Trip Orientations

These orientations are designed to prepare the teachers and adult volunteers for the Slow the Flow field trip. The trainings consist of: (1) an overview of the U.S. Fish and Wildlife Service and the Don Edwards S.F. Bay National Wildlife Refuge; (2) a review of the Slow the Flow program specifics and goals and what to expect on the field trip day; (3) a tour of the San Jose/Santa Clara Water Pollution Control Plant; (4) participation in Refuge field trip activities; and (5) field trip planning assistance and discussion on how to use the educator's guide. There were 3 Slow the Flow orientations offered at the Environmental Education Center and Water Pollution Control Plant. A total of 10 teachers and 1 parent were trained for the Slow the Flow field trip program.

The Slow the Flow program also includes an educator's guide, modeled after the *Salt Marsh Manual* used in the Wetland Round-up field trip program. The educator's guide is available free of charge to all educators who attend a Slow the Flow field trip orientation. The guide provides teachers with introductory information, field trip preparation information, pre-visit activities, post-visit activities and field trip activities. The activities are written in script format, making it easy for adult volunteers and teachers to follow during the field trip and for pre- and post-trip classroom work.

Educational Resources

The Audio Visual Lending Library for the Environmental Education Program exists at both sites. VHS videos are available for educators to check out for 2 to 3 week periods.

It's Sloughpendous! This 20-minute video is now required for 3rd- 6th grade classes to view before they come on their Wetland Round-Up Field Trip at the Visitor Center in Fremont. We mail the video 2 weeks prior to the field trip. The video features a group of students discovering the importance of the San Francisco Bay Watershed. These students explore the habitats and endangered species at the Don Edwards San Francisco Bay National Wildlife Refuge, learn how their own actions influence the plants and animals of the salt marsh and discuss what they can do to help. The video was underwritten by the Hut Foundation, the Rathmann Foundation, and Chevron Research and Technology Corporation.

In Celebration of America's Wildlife. This 28-minute video features success stories in wildlife conservation. It is appropriate for grades 4-adult.

Do your Part! This 19-minute video features a group of students teaching one another how to help preserve wetlands. It is appropriate for grades 3-8.

Fabulous Wetlands. This 8-minute video takes a humorous yet informative look at wetlands, what they are, their importance, and what we can do to protect them. Perfect for pre-field trip preparation, this video is appropriate for grades 3 -12.

A Home for Pearl and its accompanying guide teach about wildlife habitats. The video is divided into four parts: two 15-minute segments and two 20-minute segments. Each can be viewed as a separate unit, incorporating supplementary activities provided in the guide. Appropriate for grades 1-6.

Into the Wild. This video is divided into three segments, each focusing on one endangered species and the steps being taken to help it recover. The featured species are: whooping cranes (12 minutes), red wolves (12 minutes), and whales (16 minutes). Recommended for grades 3-6.

It's Wet, It's Wild, It's Water! This up-to-date look at South Bay water conservation and pollution prevention issues is appropriate for students in grades 3-8. The viewer learns where water comes from and where it goes by traveling with student reporters to the Sacramento-San Joaquin River Delta and the San Jose/Santa Clara Water Pollution Control Plant. The video underscores our connection to our watershed and emphasizes how students can actively prevent water pollution and help protect our environment.

Kids By the Bay features a group of students who are lending a hand to help the environment and the San Francisco Bay. They participate in habitat restoration projects and volunteer at Wild Animal Shelters. Appropriate for grades 3 - 12.

Secrets of the Bay. This 25-minute video about the San Francisco Bay and Delta depicts the history of the Bay and its sometimes conflicting interests. This video is appropriate for grades 4 - college.

The Surfer, the Garbageman, and the Lady in the Sky is a 15-minute video which portrays a high school student sleeping in class and dreaming about soil, air, and water pollution and the ways to help prevent it. It is a fun, fast-paced video for grades 4-8.

Tinka's Planet is a 12 minute-video that introduces children to the need for recycling. Appropriate for grades K-3.

Water You Doing? This video is divided into five six-minute segments that discuss water quality in Puget Sound in a fun and informative manner. The information presented in the video provides an excellent transition into a discussion of water quality issues in the San Francisco Bay. Recommended for grades 3-8.

Who Did the Owl Eat? This video depicts a barn owl's hunting and eating habits, its regurgitation of an owl pellet and directions on how to dissect the pellet. Appropriate for grades 1-6, the video is accompanied by charts, curriculum, and script. Educators are encouraged to copy the tape and charts to keep in their school curriculum library for future use. Other refuges have copied the tape to lend out to educators.

In addition to classroom videos, several training videos are available through the Audio-Visual Lending Library. Educators can show the videos to adult leaders as training for an upcoming field trip. These training videos consist of background and "how to" information and footage of the activity during an actual field trip.

Wetland Round-Up Field Trips at the Newark Slough Learning Center
Mud Creature Study at the Newark Slough Learning Center.

Educator Workshops

The environmental education staff, Fran McTamaney, Sandy Spakoff, Genie Moore, and Jamie Ruffennach conducted and attended several environmental education workshops in 2000.

Resources in Environmental Education Fair. The Resources in Environmental Education Fair (REEF) workshop was held in March, 2000. Environmental Education Specialist Fran McTamaney conducted a California Indian workshop and was a course leader for the two-day California Indian course. SCA interns attended and distributed Refuge information. Fran is on the REEF committee.

Educational Programs, Courses and Organizations

The environmental education personnel were involved in varying degrees with the following courses, programs, and organizations.

California Aquatic Science Education Consortium. In 1990, a consortium of agencies, organizations, and citizen groups was established for the purpose of encouraging, supporting, and enhancing aquatic (fresh and marine) education programs for informal groups in the State of California. Five aquatic curriculum guides were developed: Plastic Eliminators, Water Inspectors, Fresh Water Guardians, Wetland Protectors, and Creek Watchers. These guides are available for sale from 4-H SERIES PROJECT/CASEC, Human & Community Development (916) 752-8824. The environmental education staff uses activities from these guides when conducting educator workshops on and off-site.

California Resources Environmental Education Consortium (CREEC). Fran McTamaney represents the Refuge in two of the CREEC regions (because the EEC and the VC are in different regions). This consortium provides a statewide forum for environmental education and is funded by the State Department of Education. Services to participating organizations and educators include a Web site to post job openings, special events and field trip programs. Information workshops are held twice a year in each region.

Midpeninsula Environmental Education Alliance. Fran worked with this informal group of environmental education agencies and organizations located in Santa Clara and San Mateo counties to provide a forum for collaboration among environmental educators which would

maximize resources and achieve common goals. During 2000, the group shared expertise about volunteer training, grant writing, program planning, monitoring and assessment, entrance fees and environmental education activities. They also developed a Website for the association.

National Conservation and Training Center (NCTC) Courses. Public Outreach, Advocacy, and Education: Overview and Planning. Participants learned about education and outreach strategies and how these strategies could help achieve resource management objectives of the Service. Fran McTamaney presented the session entitled "Strategies That Work! San Francisco Bay National Wildlife Refuge" and demonstrated how each activity conducted at the Refuge met a resource management objective. In the spring, Fran attended a 2-day evaluation and revision meeting for this course.

Santa Clara Valley Environmental Partners. Environmental Education Coordinator Fran McTamaney serves with this group of environmental educators from Santa Clara County to promote environmental education in the South Bay. In 2000, this group assisted with the development of the new Environmental Education Certificate offered by the California Department of Education.

Watershed Mapping Poster. In 1996 a watershed map committee was formed between members of local municipalities and organizations to provide a versatile tool for educating school children and the public about the watershed of the Santa Clara Valley. Environmental Education Specialist Sandy Spakoff served as the chair of this committee.

Using a prototype map, which illustrated both the color and perspective of the final poster, members of the committee raised funds for production and printing from Santa Clara Valley foundations, nonprofit organizations, municipalities, and businesses, and the U.S. Fish and Wildlife Service San Francisco Bay Program. After many years of discussion and fundraising, 15,000 posters of the *Santa Clara Basin Watershed - A View to the South* (dimensions 24" X 36") were printed and made available in the Fall of 2000. The finished poster has received tremendously positive reviews from both project supporters and users of the posters. Fran McTamaney and Genie Moore gathered and organized watershed activities into a Resource Guide as the education component to accompany the poster. This Resource Guide is available on-line at www.evols.org/watershed.html.

4. Interpretive Trails

The Refuge has one trail with interpretive wayside exhibits, the Tidelands Trail. This 1-mile loop leads visitors through the different habitats at the refuge-- salt marshes, salt ponds, tidal sloughs, mudflats and upland-- and explains their ecological significance. The signs along the trail also describe the cultural history and geology of the areas through which the visitor is walking. They are entertaining, easy to read, visible without being intrusive and serve as an important supplement to our interpretive effort. Tidelands Trail is registered as a National Recreation Trail in the National Trails System.

The exhibits along Tidelands Trail are especially important during hours in which the Visitor Center is closed. Before 10am, and from 5pm to either 6pm or 8pm, the Visitor Center is closed, but trail use can still be heavy. Refuge volunteers are sometimes available to patrol the trail, talking with visitors and providing information as needed, but they cannot always be there when a visitor has a question. Interpretive signs help visitors answer their own questions about the Refuge, its habitats, and the plants and animals which use those habitats.

Many trails on the Refuge also serve the public as sites for interpretive programs. Tidelands Trail is used for a number of programs, such as A Geological Trip Through Time and Bike the Bay. Parts of Mallard Slough Trail at the Environmental Education Center are used for interpretive programs, as well, such as Children's Bird Walk and Salinity Sleuths. This trail was still well-used in 2000, despite trail closure due to salt company levee maintenance beginning in August, 1997, and the dredging of an adjacent salt pond.

Trails are maintained largely by volunteers, who pick up trash and make note of the wildlife they see. Many trails are available for both hikers and bicyclists.

6. Interpretive Exhibits, Demonstrations, and Special Events

The Refuge provides a variety of free interpretive programs to visitors. This year, our programs explored such topics as salt marsh ecology, shorebirds, migratory birds, seasonal wetlands, endangered species, plants, geology, water pollution, mammals, Native Americans, and astronomy. Refuge volunteers led about 98% of our weekend interpretive programs. See section H.7 for more detail. A complete description of these programs is also provided in the calendar section of the *Tideline* newsletters included at the back of this narrative.

Our program audiences were as diverse as the program topics presented. Audubon chapters, day care centers, garden clubs, historical societies, scout troops, community groups, senior centers, teachers' associations, and college classes are just a few of the groups which took advantage of the available programs. The greatest demand for naturalist-led activities, however, came from families, and many programs were geared specifically towards children. At the EEC, the greatest demand for these activities came from scout groups and home-schoolers.

The volunteers who staff the desk at the Visitor Center help visitors orient themselves to the Refuge and learn about its inhabitants. When the Environmental Education Center is not being used by a school group, staff and volunteers provide information and assistance to drop-in visitors at the Environmental Education Center in Alviso.

Throughout the year, staff members left the Refuge to speak at numerous civic, business, church, and social organizations. Staff members also participated in career fairs for high school students, establishing ties with nearby communities while disseminating information about the Refuge and its resources.

Many other off-site events helped to increase recognition of the Refuge and its programs. Staff members and volunteers tended information booths at these events, where they distributed literature and in some cases led environmental education activities, reaching over 5,000 people. The Bay Area Environmental Education Resources Faire for K-12 educators, the Santa Clara Audubon Society Education Day, City of San Jose Earth Day, and many other special events all provided opportunities for the Public Use staff and volunteers to reach out to the public.

Interpretive Program Statistics

During 2000, 220,351 visitors participated in interpretive activities at the Refuge. Of these, 218,237 took advantage of our self-guided interpretive trail, viewed exhibits, or visited the Visitor Center or the Environmental Education Center to look at the educational displays and watch films or videos. The remaining 2,114 participated in the numerous naturalist-conducted programs such as walks, van tours, talks, slide presentations, astronomy programs, or bicycle trips.

Special Events

California Coast Cleanup Day

Refuge headquarters in Fremont took part in this year's Coast Cleanup on September 16. The effort was coordinated with the Alameda County Coast Cleanup Commission. 130 volunteers participated in the cleanup, and the Refuge received some additional help from Coyote Hills Regional Park and the City of Fremont. Approximately 2,700 pounds of garbage was picked up at the Refuge.

On the same day, the Environmental Education Center assisted with a clean-up of Penitencia Creek in coordination with Santa Clara County Parks. The group removed a total of 18 grocery carts from the Creek and surrounding area, along with numerous bags of bottles, cans, and miscellaneous trash.

Duck Days

Duck Days was held at the Environmental Education Center in February with approximately 115 participants. Children colored their own bird identification books and then looked for the birds on a guided walk. A photo walk and talk was also available for visitors. The San Francisco Bay Bird Observatory presented a duck slide show and distributed information about the organization, while the Pacific Flyway Decoy Association sent representatives to demonstrate the art of decoy carving. Participants could then paint their own duck decoys and make duck calls. Staff, volunteers, and visitors braved the rain for a great event.

Earth Day

Earth Day was held at the Refuge on April 22nd and 23rd. At the EEC, a large contingent of volunteers from local corporations came to work in the Butterfly Gardens. The group cleared

most of the weeds from the Gardens. They also laid new ground cloth to prevent the growth of new weeds.

An Earth Day clean-up took place at Refuge headquarters in Fremont on April 22 from 9 a.m. to noon. 128 people participated in the event, despite questionable weather, and picked up about 3,600 pounds of garbage. BFI donated a 14-yard roll-off box and a 96-gallon recycling cart, and the City of Fremont donated 5 cases of beverages. Afterwards, the Native Plant Nursery held its biannual sale and sold several hundred plants.

Endangered Species Poster Contest

The Refuge held its 18th Annual Endangered Species Poster Contest in collaboration with Earth Day. Over 200 children entered from 14 different schools. This year, winners were notified through the schools and classroom presentations were made to each winner. Many of the teachers were thrilled to have their students win and enjoyed having a Refuge representative make a short presentation. Prizes were composed of free passes to various educational facilities. Passes were donated from the San Francisco Zoo, San Jose Tech Museum, Monterey Bay Aquarium, Lindsay Wildlife Museum, Oakland Museum, and Coyote Point Museum. International Migratory Bird Day posters and stickers were also used for prizes.

International Migratory Bird Day

Santa Clara Valley Audubon Society, San Francisco Bay Bird Observatory, San Francisco Bay Wildlife Society, and the Santa Clara Valley Urban Runoff Pollution Prevention Program produced this interpretive event with the Refuge on May 13th. One hundred twenty-three participants visited the Environmental Education Center to make nest boxes with the Audubon Society, to participate in migratory songbird gardening workshops, and to make bird masks. Participants were also able to view Gromet the Peregrine Falcon, which was especially appropriate since the Peregrine Falcon was de-listed in this year.

Kid's Day

Kid's Day was held at the Environmental Education Center on August 5, and 130 people participated. Visitors colored pictures of common birds, compiled the pictures into a Field Guide and then looked for those birds outside on a guided walk. Sulphur Creek Nature Center participated again this year, bringing a variety of native animals for visitors to view. Visitors also explored life in the marsh on guided Marsh Walks.

National Wildlife Refuge Week

This year, most National Wildlife Refuge Week events were held on the Refuge itself. Connections to Pier Fishing kicked off the busy week of activities. Other programs included a hawk walk, a twilight marsh walk, a bird walk, an astronomy program, and two evening lectures on Gull and Tern nesting colonies of South San Francisco Bay and Wonders of Farallon National Wildlife Refuge. A flyer attached to the end of the narrative provides a more complete description of activities.

The Connections to Pier Fishing event was a pilot program for the Refuge in collaboration with the California Department of Fish and Game (CDFG). This free event was limited to the first 50 visitors and taught basic fishing skills such as knot tying, rigging the pole, identifying fish, and learning about safety and ethics. Participants gathered information from various stations and then borrowed a fishing pole provided by CDFG to try their own hand at fishing from the pier. Participants also received a free "tackle" box with two sets of rigging. Although the Pier Fishing event was set up for 50 people, 22 people participated and four jacksmelt were caught. All fish were released back into the Bay.

On Wednesday, October 11 and Thursday, October 12, 2000, environmental education staff and interns set up information booths at local shopping centers to spread the word about National Wildlife Refuge Week and what we do here at the Refuge. Staff and interns passed out information and talked to shoppers. To help advertise Shark Day, the intern even wore a shark costume! On Friday, October 13, 2000, approximately 70 children and parents participated in the Campfire Sing-a-long with Mary Miche, a well-known children's song recording artist. On Saturday, over \$4,000 worth of plants were sold at the Native Plant Sale.

The week's festivities ended with Shark Day on Saturday, October 14th at the Environmental Education Center. Visitors participated in nature walks which discussed the role sloughs play in the life cycle of Leopard Sharks. The walk also discussed major threats to sloughs such as urban runoff pollution and habitat alteration due to water pollution control plant effluent. Inside the Center itself, visitors who answered questions about sharks and the National Wildlife Refuge system were able to create their own shark tooth necklace. The Marine Science Institute participated in the event, as well, bringing out two leopard sharks for viewing and shark artifacts for visitors to touch. A Refuge biologist gave a presentation about Great White Sharks on the Farallon Islands. By the end of the day, a total of 270 visitors had come to the Center.

All told, over 600 visitors came to the Refuge specifically to participate in National Wildlife Refuge Week events.

7. Other Interpretive Programs

In spite of the efforts we made during the year to contact the public, many thousands of people do not know about the Refuge and may not be interested in endangered species, wetland preservation, or migratory birds. Reaching *these* people is one of the most challenging tasks with which the visitor services staff is confronted. With the goal of 100% awareness by the 100th birthday of the National Wildlife Refuge System in 2003, the Refuge must try extremely hard to inform people about the Refuge. People first need to know that the Refuge exists; then they need to get out to the Refuge where they can see with their own eyes what we do and what needs to be done in order to protect wildlife habitat.

In order to spread the word about the Refuge and encourage people to visit, staff participated in the following outreach efforts:

Tideline Quarterly Newsletter

Foremost among our interpretive outreach efforts is the production of a quarterly newsletter, *Tideline*. A copy of each issue of the newsletter is included at the back of this narrative. In 2000, *Tideline* was distributed quarterly to 23,000 Bay Area households, schools, businesses, churches, hospitals and libraries. It has proven to be the best way of communicating our program schedules, announcements, news stories, advertisements and editorial comments to the interested public. In fact, many of our programs were filled to capacity by *Tideline* recipients. Local publications like *Bay Nature* and *What's Happening* now request our activity schedule to be printed in their publications.

Tideline, which is financed by the San Francisco Bay Wildlife Society, is printed on recycled paper. Our mailing list is managed by Volunteer Allen Sprague who coordinates with the Outdoor Recreation Planner about any additions, deletions, and changes to the list. Each quarter, volunteers attend a peel-and-stick pot luck to help staff members apply address labels to the issues before mailing.

Web Site

Information on the web site includes directions to the Refuge, mission statements, the current *Tideline* newsletter, activity schedules, advertisements, job announcements, volunteer opportunities, environmental education information, details about the common murre project, results of the Bair Island restoration public scoping meeting, and general information about the Refuge. Past lead articles of *Tideline* are also posted and receive regular hits from people wanting information about a particular species for research.

Tidelands Trail Times

Tidelands Trail Times, a monthly newsletter for volunteers and staff members, focuses on news, events, and upcoming projects at the Refuge. This is an excellent way for staff members to recruit volunteers and to report on completed projects. Recently, the newsletter was re-named *Sloughs News*.

Native Plant Nursery

The San Francisco Bay Wildlife Society continued to manage a Native Plant Nursery that grows plants to enhance native habitat on this and other Refuges. It was also established to serve as a vehicle for reaching out and contacting non-Refuge visitors and thus bring them to the Refuge. Over 200 species of native herbs, shrubs and trees were grown in the nursery, entirely through the efforts of volunteers. The Native Plant Nursery was managed by Harry Sanders, a volunteer who is accredited as "Master Gardener" through the University of California Agricultural Extension program. However, after a decade of managing the nursery, Harry retired in October. As a result, the nursery downsized considerably, and the Refuge is now looking for a team of volunteers to manage it.

Weekend Programs at the Visitor Center

Nature Walks. Nature walks were popular at the Visitor Center and included programs such as Botanical Wanderings and seasonal bird walks. The Ohlone Audubon Society conducted bird walks on Saturday mornings and usually had 10-15 participants. Hawk walks were also popular and were conducted either in the morning or before dusk. Children's Bird Walk was heavily attended by families; children attending the program made their own field guides and then hiked the trail to find the birds. The Sequoia Audubon Society also began nature walks on the newly acquired Bair Island. Their nature walk involved birding on Inner Bair Island and a discussion of the history of the area and possible plans for restoration.

Bike the Bay. Visitors took a slow and easy bicycle tour of the marshes and salt ponds along dirt levees and trails. They learned about the ecology and history of the salt marshes of San Francisco Bay.

Canoe the Sloughs. This interpretive introduction to the natural history of the Refuge took place in the Refuge's tidal slough in the visitor's own canoe or kayak. During the 2-3 hour trip, the group made 6-8 stops to hear a short talk on salt marsh ecology, endangered species, migratory birds, or Native Americans. Participants brought their own canoe or kayak.

Drawbridge Slide Show. A popular slide show that describes the ghost town of Drawbridge which is located in Alviso. Visitors are entertained with stories about life in the town built on a marsh. Tours to the actual site of Drawbridge had to be discontinued due to safety reasons.

A Geological Trip Through Time. Visitors took a walk on the Tidelands Trail and examined the geological features of the Refuge and the San Francisco Bay, and its effects on plant and animal life. They then returned to the Visitor Center to make a take-home geologic model of California.

Mysteries of the Cosmos. Children and adults alike enjoyed a series of stories as they were told by Native Americans about plants, animals and creation.

Night Skies. An astronomy program that discusses the stars and their meanings to various cultures. Visitors can view star clusters, Mars, Saturn, or the moon through a high-end telescope, depending on the time of year.

The **Discovery Pack Program** is designed for families and other groups who want to hike the Tidelands Trail and take an up-close, self-guided look at the plants and animals along the way. Discovery Packs are kept in the Visitor Center and can be checked out by visitors (such as families, scout groups, etc.) The packs contain activity ideas for investigating the habitats at the Refuge, such as mini-expedition, brine shrimp lab, and bird bingo. The person who checks out the pack leaves their driver's license with the volunteer at the desk. When they return the pack, they clean the equipment, count items issued, and retrieve their driver's license. A sign at the Visitor

Center and an announcement in *Tideline* advertises the program. In 2000, a total of 502 people used the Discovery Packs.

Weekend Programs at the Environmental Education Center

Beginning Bird Workshops for Kids. During this program, kids colored pictures of birds likely to be seen from the trails at the Environmental Education Center. After assembling their pictures into a book to use as a field guide, they went outside to see if they could find these birds in the wild. For each bird they found, they received a sticker to mark the page in their field guide.

Bird Walks. Guided Bird Walks were the most frequently presented programs at the EEC. These two-hour-long walks usually took place in the morning with an average of 10 to 20 participants. Most bird walks provided a general survey of the bird population, but others focused on a particular group of birds such as shorebirds or breeding birds. The majority of participants were new to birding and enjoyed the opportunity to learn about even the most common birds of the Refuge. Sometimes a sample of mud or water was collected in order to observe first-hand the organisms birds eat.

Butterfly Wonders. These interactive programs included indoor presentations and guided walks. Visitors were introduced to local butterflies and their adaptations, and to the native plants on which they depend. Tips were given for attracting butterflies to gardens and preventing pollution from pesticides. In addition, workshops were given about how to monitor butterfly gardens, noting which plants were successfully attracting butterflies, and how the butterflies were using the plants.

Decorating For The Birds. Visitors took a walk through the chemical-free demonstration gardens, learning about common plants birds enjoy. They returned to the building to create their own pine-cone seed feeders and learn how to make their garden more attractive to birds.

Evening Programs. In Twilight Hikes, visitors observed the diversity of life dependent on wetland habitats, and learned about the important ecological roles they play in the Bay Area. These programs were extremely popular when offered.

Labor Day Picnic and Game Day. Visitors ate lunch with the Interpretive Specialist and then participated in a number of games including Habitat Trivia, Pollution Volleyball, and the Water Cycle Obstacle Course.

Pond Scum Mystery. Visitors hiked through Refuge habitats, learning about the sloughs, wetlands, and watersheds. They then returned to the building to perform a brief chemistry experiment which demonstrated the effects of storm drain pollution on oxygen levels in the watershed.

Quacky's Quirky Adventure Puppet Show was presented at the Environmental Education Center. Participants hiked around Refuge habitats and then returned to the building to watch a puppet show about Quacky the duck. Through a series of events, the duck and his friend discovered that urban runoff was threatening his home.

Scavenger Hunt. Visitors attended a nature hike with an urban runoff-related theme. They then returned to the building to search for hidden questions. After answering the questions, visitors won prizes.

Requested Programs

Many groups contacted the Environmental Education Center in request of programs tailored to meet their groups' individual interests and needs. Each program presented was unique, but they all revolved around the theme, Our Role in Preventing Urban Runoff Pollution. Scout packs and troops, Lyceum groups, after-school child care centers, universities and colleges, and senior centers participated in tours of the wetlands at the Refuge. In discussions and activities they learned about the uniqueness of the habitats, the diverse life dependent on them, basics of ecology and natural history, and other concepts such as protection of wildlife through prevention of urban runoff pollution from storm drains. Programs included Pond Scum Mystery, Whooo Did the Owl Eat, Habits and Habitats, and a Cub Scout Walk for Achievement 5.

Slow the Flow Interpretive Programs

These weekend programs incorporated the ideas from the Slow the Flow field trip program into fun, hands-on Refuge exploration. Programs focused on wastewater treatment, habitat alterations, and water conservation. They included: owl pellet dissections combined with a discussion of the effects of habitat alterations on the barn owl's home; a human board game of puzzling pipes where participants travel down our sewer system to the Water Pollution Control Plant or make their way down storm drains; a tour of the Water Pollution Control Plant followed by Refuge habitat exploration. All programs were free and open to the general public.

Off-Site Interpretive Programs

Throughout the year, staff members spoke to numerous civic, business, church, and social groups, establishing ties with nearby communities while disseminating information about the Refuge and its resources.

Quacky's Quirky Adventure puppet show was presented at a number of schools and libraries for audiences ranging in size from 30-260 children.

The Refuge presented story time in conjunction with urban runoff pollution prevention games at the Alviso library.

Refuge staff presented an after-school program at the Alviso Community Center teaching about water conservation and urban runoff pollution prevention through games as well as arts and crafts.

8. Hunting

The walk-in hunting area at Ravenswood was open to hunting this year but the salt ponds were dry. This provided less than optimal hunting conditions. Approximately 1,000 hunters used the Ravenswood unit this year which was very low and they had a very low take ratio.

Approximately 3,000 hunters utilized the remaining open areas. These areas are opened to boat access only. These hunters reported low numbers of waterfowl being present compared to previous years.

Refuge Law Enforcement Officers and California Department of Fish and Game Wardens patrolled hunt areas during waterfowl season.

9. Fishing

Anglers made good use of the Refuge's salt water fishing areas, which served an estimated 6,000 saltwater anglers. Coyote Creek Lagoon, at the southeast portion of the Refuge, remained a favorite bank fishing spot for those hoping to hook a white sturgeon. Dumbarton Fishing Pier and the adjacent north and south trails along the Bay continued to be our most popular location for beginners and more experienced anglers alike. Fishing from or near the pier netted a variety of fish: leopard shark, sand shark, bat ray, shiner surf perch, kingfish, bullhead, striped bass, and white sturgeon.

The access road to the Dumbarton Fishing Pier is closed to motor vehicles from April through August each year to protect the threatened western snowy plover which nests adjacent to the road. Plover chicks have been known to enter the roadway, which puts them at risk of being struck by traffic moving to and from the pier. However, the road is still open to pedestrian and bicycle traffic, and a shuttle is available by reservation to take anglers to the fishing pier on weekends.

A recent Environmental Health Hazard Assessment has advised anglers to limit the amount of Bay fish that is eaten. Warning signs explaining the hazards are posted in Korean, Spanish, Cambodian, Chinese, Vietnamese, and English at the Dumbarton fishing pier and at Coyote Creek Lagoon.

11. Wildlife Observation

Many visitors come to the Refuge for the opportunity to view wildlife in its natural habitat. The Refuge has a variety of habitats such as salt marshes, salt ponds, sloughs, mud flats, open water and upland coastal chaparral, grassland and trees. This range of habitats provides an ideal area for visitors to explore, on their own or with our naturalists, when seeking local wildlife.

Most visitors walked or biked the many miles of Refuge trails on their own, viewing resident nesting birds, migrating and wintering shorebirds and waterfowl, and young birds during the

spring and summer months. In addition, many nature study groups led field trips to our Refuge, and three chapters of the Audubon Society once again conducted its annual Christmas bird counts here. Ohlone Audubon covered the Alameda County area, Santa Clara Audubon covered Alviso salt ponds, and Sequoia Audubon covered Bair Island. During hours when the Visitor Center was open, visitors could check out binoculars from the desk to view wildlife along the trails.

One of the most popular sites for local bird watchers was the restored tidal area, LaRiviere Marsh, where great numbers of shorebirds and migrating waterfowl gather to feed. A Peregrine Falcon is commonly sighted here, and several pairs of the endangered California Clapper Rail have also been spotted.

17. Law Enforcement

The Refuge Law Enforcement Program focuses on Resource Protection, Resource Education, and Public Use Management. As visitation increases at the San Francisco National Wildlife Refuge Complex these will remain a challenge to achieve.

Patrolling has been done selectively depending on previous incidents and the number of visitors using the area. Patrol activities in the North Bay are conducted by officers from the main headquarters. These have been limited to weekends with each of the two full time officer visiting each North Bay Refuge an average of one time each month. The Monterey Bay Refuge units were patrolled by the manager for the units until he left the Complex. After he left, patrol of the Monterey Bay Refuges were done by the two full time officers on an average of once a month for each Refuge.

In April 2000, Officer Clyde Morris completed the Basic Police Academy at the Federal Law Enforcement Academy in Glynco, Georgia. This was followed up by attending the Refuge Officer Basic Academy in October at the United States Fish and Wildlife Service National Training Center in West Virginia. This resulted in an additional collateral duty officer for the refuge complex.

Incidents of Note

a. On April 9, 2000 at approximately 6:00PM, Officer Adamson drove into the visitors center parking lot and observed a visitor in apparent distress and that his clothes were wet. Officer Adamson asked if he needed assistance. Mr. Olave stated that he had lost his friend when their small 13-foot aluminum boat had capsized in Newark Slough and that Mr. Lazano had not been wearing a Personal Floating Device when the boat capsized. Units responding to refuge requests for assistance included Fremont Fire Department Paramedics, Menlo Park Fire Department Air Boat, Fremont Police K9 unit and additional officers, and a United States Coast Guard helicopter. Some time later the boat was found within sight of the visitor center at a location approximately one mile west of the west Foot Bridge of Newark Slough. The main search was conducted between 8:00PM and midnight. The search resumed before 5:00AM the next morning. A search

of the entire length of Newark Slough was conducted to no avail. The search was suspended at the end of the second day.

On April 19, 2000 at approximately 4:50PM, a visitor returning from a fishing trip out on the bay with the family reported seeing a body floating in the slough. Appropriate agencies were called and the body of Arturo Lazano was recovered and later positively identified. The use of alcoholic beverages may have played a part in this tragedy along with boating without a life jacket.

b. On April 22, 2000, a small passenger plane ran out of gas approaching the Palo Alto airport and crashed into the southern end of the Feber-Laumeister Parcel. There were no injuries. The plane skidded across approximately 25 feet of marsh and up and over the San Francisquito Creek flood control channel berm. It stayed resting partly on the berm and partly in the Creek until it was removed by a helicopter under the authorization of a Refuge Special Use Permit.

c. On June 19, 2000 at approximately 1 PM, a contracted helicopter flew over the Farallon National Wildlife Refuge. The helicopter was being used to film a "glamour shot" of the islands for the purpose of tourism in Japan. The helicopter made numerous passes over and around the islands. This caused a disturbance of 1500 nesting Common Murres and other species. Due to the swiftness of reporting by PRBO biologists living and working on the island, the helicopter was intercepted as it landed in Oakland, California. The pilot was later issued a number of citations for wildlife disturbance. The pilot challenged the citations on the grounds that the Service cannot control air space and that this duty falls under the Federal Aviation Administration. The United States Attorneys Office is proceeding against the pilot using the "Airborne Hunting Act." On April 23, 2000, a grand jury subpoena was served on the helicopter service that provided the helicopter. This subpoena requested that the company furnish all personnel, flight records, and contracts concerning the pilot.

d. On September 19th, 2000 at approximately 6:50PM, Officer Tarbet stopped a juvenile for driving the wrong way on Marshlands Road in the vicinity of the refuge fishing pier. The juvenile furnished false information as to his identity and the vehicle registration check showed the vehicle was stolen. Local law enforcement was called and the suspect was taken into custody for possession of a stolen vehicle and giving false information to a police officer. The suspect claimed that the car had been parked at pier with the keys in the ignition for three days and that he had just driven the car for the first time when Officer Tarbet contacted him that day.

e. On November 29, 2000 Refuge Officers were part of a team when a Federal search warrant was served in San Francisco, California. The search warrant came about when a tip was acted upon by the U.S. Fish and Wildlife Service Division of Law Enforcement Special Agents. An undercover special agent purchased a mounted eagle from a private person for \$2,000.00. During the purchase, other wildlife violations of California and Federal law were observed.

The search included a business and two private residences. Two warrant teams were assigned and a total of 18 personnel (9 California Game Wardens including a technical support team along with

9 Federal officers/support personnel including three Refuge Officers from this Complex) were utilized during the search. The outcome of the search and the subsequent charges are still under investigation. According to the suspect, the mounted eagle and other wildlife parts and mounted birds were purchased at a swap meet. There was no physical arrest and charges were filed through the United States Attorneys Office by the Division of Law Enforcement Special Agents.

f. On October 12, 2000 at approximately 2:25PM, Officer Morris received a call from the Fremont Police dispatcher who reported that a fisherman had seen a body lying in the marsh north of the Dumbarton Bridge on Refuge property. Upon arrival, an East Bay Regional Park Police helicopter and units from the Fremont Police Department were already on the scene. The Refuge is concurrent jurisdiction. An unattended death investigation was conducted by the Fremont Police Department. The body was that of a woman believed to have committed suicide by jumping off the San Mateo Bridge north of the refuge. The mother later identified the body after reading of the incident from the local newspaper. The victim's car was found on the San Mateo Bridge unoccupied.

g. In response to concern for ongoing disturbance of nesting seabirds and marine mammals along the Central California Coast and offshore islands (Farallon NWR), on December 12, 2000 an interagency coordination meeting was held at the Gulf of the Farallones National Marine Sanctuary. Representatives from the USFWS, National Park Service, DOI Solicitor's Office, National Marine Fisheries Service, Gulf of the Farallones National Marine Sanctuary, U.S. Attorney's Office, the Common Murre Restoration Project and Point Reyes Bird Observatory were in attendance.

After discussing the importance of the resources to be protected and the law enforcement options that each agency had to protect these resources, it was decided to take a two pronged approach to the problem: law enforcement and outreach. It was agreed to develop a violation reporting form to be used by field biologists and a form identifying "which Law Enforcement Agency to contact when you want report violations in each of the areas". Each of these forms would be drafted and finalized at the next Law Enforcement group's meeting in 2001. The Outreach group would work to map sensitive areas (those with nesting seabirds) and use them for outreach to pilots, boaters and the military. California Department of Fish and Game would be encouraged to attend the next meeting.

h. This has been a year for records. Marshlands Road is the main road through the Refuge to access the Visitor Center, Refuge Offices, and at the far end, the Dumbarton Fishing Pier. Marshlands Road continues to be closed from approximately April 1 to the end of August to protect nesting snowy plovers and other water birds. It also runs parallel to State Highway 84, a main corridor from the West side of the bay to the East side via the Dumbarton Bridge. Between January 1 and December 31, 2000, there have been 13 documented crashes through the fence from the highway onto Marshlands Road. Some of the accidents include serious injury. Some of the cars make it into the salt ponds that are adjacent to the road. All accidents have property damage to the vehicles and or the fence line. There are signs (holes in the fence, glass scattered across the

pavement, and debris strewn around the area) of other accidents that have not been reported to the Refuge. The unreported accidents occur when the refuge is closed and no refuge personnel have been advised that an accident has taken place.

During Fiscal Year 2000, Refuge Officers documented 128 incidents on the Refuge. 94 Federal and State citations were issued. Refuge Officers assisted other law enforcement agencies in 49 cases. Twenty-one miles of boundary were posted on Bair Island.

18. Cooperating Associations

For 13 years, San Francisco Bay Wildlife Society (SFBWS), a nonprofit cooperating association, has sponsored and underwritten education and outreach programs for the Refuge. Originally established to just support one refuge, the association grew to the position of assisting 8 other National Wildlife Refuges by 2000.

SFBWS cultivated income from a variety of sources to support its own overhead and Don Edwards San Francisco Bay NWR; bookstore, native plant and publication sales, memberships, donations, corporate, foundation and government grants, and events. The education, interpretation, and volunteer programs of the Refuge all benefitted from SFBWS revenues. The major uses of funds continue to be the *Tideline* newsletter, the volunteer program, general publications and capital equipment.

Combined bookstore sales from the Fremont Visitor Center (VC) and Alviso Environmental Education Center (EEC) was less than anticipated with an income of \$38,524. Community fairs and Refuge events continue to be top sales events for the bookstore. Popular inventory items continue to be logo merchandise items that incorporate the Refuge name as well as finger puppets, magnets, key chains and other items retailing for less than \$5.00.

Successful grant proposals written by both Society and Refuge staff members yielded financial support for Refuge education programs. Corporate and foundation grants were awarded for equipment and supplies as well as for enhancement of education programs.

For the sixth year, the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program) [a collective group of municipalities cooperating to improve water quality in the Santa Clara Basin Watershed] granted over \$70K for a full-time employee at the Environmental Education Center (EEC). These contract funds enable the EEC to remain open on the weekends - there is no funding in the station budget for weekend FWS FTE's at this site. Additionally, interpretive programs educate participants about the value of wetlands and ways that individuals can protect them by preventing non-point source pollution; and gardening workshops enhance Refuge grounds as participants remove non-native plant species without the use of chemicals.

For the second year, the City of San Jose, California granted over \$50K for a full-time employee at the EEC. These contract funds, combined with those from the Program, enable the EEC to

remain open on the weekends additionally, an environmental education program has been created to reach Middle & High School students – a new audience. The goal of the program is to teach teens to conserve water and thereby reduce the amount of fresh water effluent entering the salt marsh habitats of the South San Francisco Bay.

Two grantees (Northern California Grantmakers and Sierra Club) and a private donor (Rudy Driscoll) provided \$10,000 to the Refuge's summer day camp program. The additional monetary support enabled education staff to expand the program and offer it, for the first time, in the underserved, low-income community of East Palo Alto. Day camps were held for one week at each site - Fremont, Alviso, and East Palo Alto. The campers learned about many different natural habitats at the Refuge in a fun, positive setting. Participants also gained an appreciation of the environment and the importance of demonstrating personal responsibility. As a result of the program, many of the children began to apply the concepts they learned in their daily lives.

After several years of planning and deliberation, the Santa Clara Basin Watershed map (Map) project got underway. The map will be a bird's-eye-view of the South San Francisco Bay watersheds. By using the Map at educational programs, community events, and educator workshops, Refuge staff will illustrate that no matter where a person lives or works within the entire Santa Clara Basin watershed they have an impact on the wetlands surrounding the Bay. Students will be able to discover their own connection to the watershed and how it affects their daily lives. A myriad of municipalities, environmental organizations, and corporations such as the Cities of Cupertino, Milpitas, Palo Alto, Mountain View, Sunnyvale, and San Jose; Alameda County Clean Water Program; Save San Francisco Bay Association; Youth Science Institute; Environmental Volunteers; Hewlett-Packard Company; and Intel Corporation are among those who provided financial support. During FY 2000, nearly \$7,000 was used to kick off this \$40,000 project.

A nine-member, all volunteer Board of Directors sets policies for the organization. Cecily Harris, full time Executive Director who managed finance, fund raising, and Refuge relations activities for the Society resigned in the summer. Other Refuge volunteers assist with the bookstore, membership, and bookkeeping activities.

I. EQUIPMENT AND FACILITIES

1. New Construction

Native Plant Greenhouse Construction:



Prior to 2000, propagation of endangered plants for Antioch Dunes NWR has been done by contract nurseries and, to a limited extent, in our native plant nursery. The new greenhouse was constructed because space at the nursery was insufficient to grow the quantities needed. Also, the biologists wanted more control over propagation of endangered species. At the nursery, sometimes endangered plants were accidentally getting watered by volunteers. Research into the greenhouse design/size/vendors began in 1999. Construction of the greenhouse involved grading an area next to the native plant nursery, plumbing the site, preparing a gravel bed, and actual construction of the building. Maintenance staff did the construction in October and November of 2001. A volunteer, Kuni, constructed the greenhouse tables.

Bair Island Kiosk:



During the Spring of the year, maintenance worker Arthur Chan designed and built an information kiosk for Bair Island. The kiosk was installed by all three Refuge maintenance staff members near the Whipple Road gate entrance. As well as having a large attractive Refuge sign at this lone entry point, the kiosk brochure box now provides approximately 250,000 annual visitors general information about the Refuge, Bair Island, and rules for public activities.

2. Rehabilitation



Environmental Education Center Repairs:

Over a 3-month period during the Summer, repairs were made to the siding and decks of the Environmental Education Center and Pavilion at Alviso. Work was completed by three Refuge maintenance staff, Youth Build members, and a contractor. Youth Build is a program for “at risk” youths, which prepares them for an apprenticeship in trade work. For the Education Center, old siding was removed and replaced with new T1-11 siding, the siding was stained and trimmed, exposed glulams were covered with sheet metal, new joists were installed under the back entrance deck, and decking was replaced. Repairs to the Pavilion included trim replacement and staining of the siding.

Headquarters Visitor Center Repairs:

During September, maintenance workers Arthur Chan and Juan Flores repaired structural beam support for the front entrance deck of the Visitor Center. A small number of decking planks were replaced and the entire deck surface was repainted.



Sinkhole Repair:

The project known as the Sinkhole began when an old concrete pipe in a levee, left over from pre-refuge salt evaporation operations, began collapsing and a sinkhole developed. The sinkhole developed on the trail within 50 feet of the Newark Learning Center laboratory. The area, subject to tidal flows, was closed to public use due to the safety hazard. A partnership with Ducks Unlimited and the Refuge was utilized to design, contract and install a new larger pipe and flap gate. The area was then reopened to the public. There appears to be a potential for erosion from the water rushing through the newly installed larger pipe. This will be monitored during the coming year.

Refuge Headquarters Window Replacement:

The headquarters and visitor services building were constructed before safety glass was required. In a seismic evaluation certain windows were identified as hazardous due to their height and proximity to public and employee use areas. Funds were acquired and a contract was issued to replace prioritized non-tempered windows with tempered glass. More windows, down the list, could be replaced if funds become available.

Marshlands Road Repair:

Refuge Manager Clyde Morris and Project Leader Marge Kolar worked with Caltrans concerning the deteriorating conditions of Marshlands Road. The road is owned by Caltrans and had been under lease to the Refuge but the lease had expired. Large cracks have developed in the road which can cause bicyclist to catch their tires and fall, vegetation is growing in the cracks which causes bicyclist to ride in the motorized section of the road rather than in the bike lanes, sections of the edges are failing, a section of the guardrails above the Newark Learning Center is failing, and the roadbed is sinking around the culverts across the road creating a speed bump effect for cars and bicyclist.

Caltrans agreed to fill the cracks. They spent two weeks cleaning the cracks in preparation for the sealant. Their crack sealing truck broke after one day of filling cracks near the fishing pier. They returned for one more day to fill the largest of the cracks near Crescent Pond. The patch on the large cracks failed within months. Caltrans agreed to return the next year to address the crack issue.

3. Major Maintenance

Mud Slough Levee:

The TriCity Landfill on Auto Mall Parkway notified the Refuge that they were experiencing a large inflow of tidal waters onto their property because of a broken levee on Mud Slough between the Union Pacific Railroad and the levee for Salt Pond #M4. There was a 20' break in the levee where an old water control structure had been located. Initially, there were questions of ownership of the levee. Neither Cargill nor Union Pacific claimed the levee nor the structure. The landfill offered to repair the levee for the Refuge. In March, they had Cooper Crane & Rigging use a 90' boom crane to install 25' long sheet pile in the break to stop the water flow by forming a temporary wall. They intended to return in the dry part of the year to rebuild the broken levee with imported clean and dry bay mud to reconstruct the levee to its original footprint and dimensions.

Within a few days of the installation of the sheet pile wall, the water eroded around the ends and tidal flow once again flowed up the channel to the Landfill property. The sheet piles began to bend under the pressure of the water and were removed by Cooper Crane. The Tri-City Landfill said

they would return again in 2001 to reestablish the levee with a water control structure. In the mean time, the flooded area on the landfill property provided ideal habitat for wintering waterfowl.

Viewing Platform Removed:

A wooden, public viewing platform was dismantled and removed from the Triangle Marsh levee by maintenance staff members, Juan Flores, and Arthur Chan. This work was done in preparation of a marsh restoration project involving improvements to the levee.

Hazardous Material Lockers:

New outdoor, hazardous material, walk-in lockers were installed at the Maintenance Shop during the Spring. Maintenance worker Juan Flores cleared brush and leveled an area immediately adjacent the shop building to prepare the building site. One contractor poured a concrete pad and installed the lockers, and a second contractor extended a new chain link fence from the existing compound. The new extension enclosed the lockers and surrounding area as part of the shop compound. All work was completed to address deficiencies identified in a regional environmental compliance audit.

4. Equipment Utilization

Refuge Vehicles:

During the year, two new International dump trucks were acquired. Two vehicles (GSA Jeeps) were replaced with leased Ford Explorers for full-time Law Enforcement officers, Barry Tarbet and Jon Adamson. An additional Ford Explorer was leased from GSA to be used by the on call duty Refuge Officer. A mower, new trailer, and dump truck were transferred to San Pablo Bay NWR.

Airboats:

Over a 3-week period during the summer, maintenance worker Juan Flores installed Teflon sheeting on the bottom surface of an airboat to reduce friction and improve performance. As well, mechanical steering and rudder drive systems were replaced with cable systems.

J. OTHER ITEMS

2. Other Economic Uses

San Francisco Bay Brand, Inc is a commercial brine shrimp harvester under contract with the Refuge to harvest brine shrimp in the salt ponds. They report their harvest on a fiscal year basis with the latest report covering from November, 1999 to October, 2000. During this time period,

they reported to have harvested 330,943 pounds of brine shrimp and 223 pounds of brine shrimp eggs, resulting in \$177,550.92 in royalty payments being paid to the Refuge for the shrimp and \$1,196.51 for the eggs.

All the shrimp were harvested during the months of April through July. 77,919 pounds were harvested from Pond M3, 111,294 pounds from M4, 93,759 pounds from M2, 19,922 pounds from A19, and 27,918 pounds from A23. They harvested 223 pounds of eggs during January from Pond A23.

4. Credits

While the entire staff had input and assisted in roughing out this 2000 edition, the following staff members were responsible for the various sections as follows:

Sections A - all

Section B, C, H.17,18 - Clyde Morris

Section C.3 - Fran McTamaney

Section D.3,4 - Clyde Morris

Section D.5 - Joy Albertson, Clyde Morris

Section E.1, Cindy Lu, Clyde Morris

Section E.2, 3, 4 - James Aliberti

Section E.6 - Barry Tarbet

Section E.8 - Clyde Morris

Section F.2,9 - Clyde Morris

Section F.10 - Joy Albertson

Section G.1,2,3,4,5,6,9,15,16,17 - Joy Albertson, Clyde Morris

Section H.1,2,3,4,6,7,9,11 - James Aliberti

Section H.8 - Carmen Leong

Section H.17 - Barry Tarbet, Clyde Morris

Section H.18 - Sandy Spakoff

Section I.1, 2,3,4 - Brian Allen

Section J.2 - Clyde Morris, Joy Albertson

Editing was done by Marge Kolar.

Typing was done by Brian Barreto.

ANTIOCH DUNES NATIONAL WILDLIFE REFUGE
Contra Costa County

ANNUAL NARRATIVE REPORT
Calendar Year 2000

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

**No Report
for Year 2000**

FARALLON NATIONAL WILDLIFE REFUGE

San Francisco County, California

ANNUAL NARRATIVE REPORT

Calendar Year 2000

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 2000

Jill Buffon
Refuge Manager

February 27, 2002
Date

Maize Kolar
Refuge Complex Manager

March 11, 2002
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 is 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 ash storm-petrel, Brandt's cormorant, and western gull. Six pinniped species also breed or haul out on the Refuge. After an absence of over 100 years, northern elephant seals returned in 1959 and now breed South Farallon Islands.

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 murre 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. While some species have re-colonized the islands, other are slowly recovering. Wildlife remain vulnerable to the impacts of pollution, oil spills, gill net fisheries and global climate changes. The Service has cooperative agreements with Point Reyes Bird Observatory and the U.S. Coast Guard to facilitate protection and management of the Refuge

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A. HIGHLIGHTS

- Productivity of seabird species was higher than average for the second year in a row (Section G.5).
- Two habitat restoration projects were completed in September: The habitat sculpture at North Landing and boardwalk to protect nesting around the buildings (Section F.6 and J.1).
- Presentations on Farallon projects were made at two national conferences: "Protecting Island Ecosystems: Management of Non-Native Rats" in San Francisco, and the World Energy Engineering Congress in Atlanta (Sections G.15 and I.6).
- A gray water system was installed in the residence, further augmenting water conservation (Section I.2).

B. CLIMATIC 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.

With the exception of April, mean monthly sea surface temperatures (SSTs) in waters surrounding the Farallon Islands from March to August were approximately 1°F cooler than the 29-year average. No extreme weather conditions occurred. No unusual weather events occurred except for several May rain showers, which sparked a longer than normal growing season and extended greenness into the late spring (see Section F.10).

Several large feeding flocks of seabirds were noted in March through June, which indicates oceanic upwelling conditions.

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, hatched in 1971, did not return to breed in K plot. He was seen a few times during 2000, so he did make it to his 30th birthday and the new millennium.

Demography, population dynamics, and food habits of common murre: Three study plots (Shubrick, Upper Upper, and Cliff) are monitored daily during the breeding season to determine number/location of breeding sites, phenology, breeding success, incubation, and chick-rearing periods. A new study plot near Tower Point was monitored this year. 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. Diet studies track food items that adults feed to murre chicks. Analysis of the 27-year diet study showed northern anchovy greatly exceed all other food items, but that there was also substantial between year and between decade variability in food items. The consumption of juvenile rockfish dominated in the 1970s and 80s, while anchovy and Pacific sardine dominated in the 1990s.

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. Life-history parameters are being investigated such as age at maturity, fecundity, longevity, mate/site fidelity, survival to breeding age, and how these relate to breeding effort and success. Their relationship to annual ocean conditions are also being examined. Methods included monitoring reproductive success of known-age birds, including several that were hatched in early to mid-1970's. 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. Pigeon guillemots fed primarily on sculpins and flatfish during 2000. Similar to murre, juvenile rockfish have also declined as a percentage of the guillemot diet. 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) have predominated.

Demography, population and diet of rhinoceros auklets: A mark/recapture study was begun in 1987. As of 2000, 640 birds had been banded and 727 previously marked birds had been

recaptured. 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 Pacific saury (48%) and anchovy (42%). Occupancy rates of natural burrows 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 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 ninth year. Petrels are mist netted and banded at two locations at least one night per month April through August. To date 2940 ashy storm-petrel have been newly banded (104 of these in 2000) and 626 birds have been recaptured (14 in 2000). The goal is to determine population size and assess population trends by comparing results with data sets from 1972. Productivity of ashy storm-petrels is monitored at known natural crevice nesting sites.

Ashy storm-petrel social attraction: This experiment, initiated in 1996 to attract petrels to nesting boxes, was conducted at three sites: Domes area on the Marine Terrace, the Eggers House at North Landing, and an area north of the Russian House (just west of the main house). The Russian House site is a new site for 2000, replacing the old redwood water tank site abandoned last year due to safety concerns with the collapsing structure. Each site contains 40 nest boxes, and taped calls of ashy storm-petrels are played continuously throughout the night (except on full-moon nights) using a solar-powered play-back system. The experiment has been unsuccessful thus far in attracting petrels to nest in boxes, and the playback equipment malfunctioned sporadically through the season.

Tufted Puffin: Daily observations at historic nesting sites were conducted during two 1-week periods (May and June) to estimate number of pairs.

Black Oystercatcher: Historic nesting sites are monitored. Fourteen were active this year and 2 chicks were color-banded. Diet samples collected in 1999 contained primarily limpets, with some

mussels and crabs.

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. Because the population is small and a pool of known-age seals has developed over many years, a unique opportunity for long-term population studies exists.

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 using scars and fin notching. The occurrence and behavior of white sharks, and the behavioral tactics white sharks use to hunt and capture their prey (primarily elephant seals on SEFI) have been described. Current 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 since 1968. In 1999 a new component to track shark movement with pop-off satellite tags was added. Two white sharks were tagged in 1999 and 6 were tagged in 2000.

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 6, 2000. 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.

Gull exclosure experiment - In October 1997 two experimental gull exclosure plots, consisting of parallel overhead cables strung 6' above ground level, were constructed: on the Marine Terrace, (50 x 50 meters), and adjacent to the Power House (30 x 30 meters). The purpose of the exclosure plots was to test whether this technique would prevent western gulls from breeding in important ashly storm-petrel and Cassin's auklet habitat, thereby reducing a predation factor. PRBO monitored the effectiveness of the plots during the 1998 and 1999 breeding seasons, and summarized the results in a report this year. In 1998 there were fewer gulls in exclosure plots versus control plots during non-breeding season, but more gulls in exclosures during the breeding season. The number of gull nests were similar between exclosure and control plots in both years. Since the exclosures did not substantially reduce gull density, they were removed in Fall 2000.

The Gulf of the Farallons National Marine Sanctuary (GFNMS) conducted the following study:

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. 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 or natural disaster. During the February visit northern range extensions for 2 algae species, a shell species and 1 crab were found, and a tagged black abalone followed for 10 years was revisited.

The Refuge occasionally issues permits to other researchers to conduct studies. During 2000 these included:

Visual discrimination by shape of white sharks upon decoys: The study, initiated in 1996 by Scot Anderson in cooperation with PRBO biologists, continued for a fourth year. The objective is to determine to what degree white sharks visually discriminate between shapes. Four decoy shapes are deployed from East Landing, and data (including photographs) taken as to whether the shark attacks or investigates the decoy. Photographs help identify individual sharks and complement PRBO's photo identification study described above.

E. ADMINISTRATION

1. Personnel



*Bart McDermott, Farallon
Refuge Operations Specialist*

Keith Gauldin, Farallon Refuge Operations Specialist, departed in April 2000. Bart McDermott replaced Keith in September. This is the second year of the ROS position, which is funded by

flood (storm relief) dollars, PRBO and Apex funds for special projects. Chris Barr, FWS Maintenance Supervisor, left in late 1999 and was replaced by Brian Allen in 2000.

Laura Williams left PRBO and Peter Pyle took over her responsibilities as Farallon logistics coordinator. Peter's role as the Fall Farallon Biologist has decreased. Peter is still active in shark and landbird research but will spend less time on the island. Adam Brown replaced Peter as the Fall Farallon Biologist.

4. Volunteer Program

During the Calendar year 2000, approximately 24 volunteers donated about 10,550 hours of service at the PRBO research station 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.

Refuge Volunteers donated approximately 519 hours during 2000. Volunteers Ross Wilming donated 40 hours pulling exotic plants and accomplishing other maintenance tasks in March. Volunteer Brian O'Neil donated 112 hours of carpentry work in May, installing inside trim on Coast Guard House windows. Brian, a professional photographer also donated over 100 wildlife and landscape images he took during his stay. The Telephone Pioneers donated a total of 225 hours in September constructing new boardwalks. Meadowsweet Dairy artists spent 112 volunteer hours constructing the Habitat Sculpture, and Volunteer plumber Moe Burke donated approximately 30 hours designing and installing the gray water system in November.

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. During 1999 and 2000 PRBO agreed to reduce the amount paid to them to help fund the ROS. Approximately \$79,922 was paid to PRBO in Calendar Year 2000.

The USFWS Coastal Ecosystem Program/San Francisco Bay Program provided \$3,000 to PRBO to complete the gull exclosure experiment report. Total funds provided for implementation and analysis of this experiment by the Coastal Program over the 3-year period were \$8,000. Coastal Program Funds (\$4,300) were also used to purchase a remote time-lapse video camera/VCR system which will be used to document predation by owls and gulls on seabird species.

The Farallon Islands Foundation donated a total of \$11,634 during 2000 to the Farallon Contributed Account for the following projects: boardwalk replacement and scrap removal.

The Apex-Houston Trustee Council provided \$25,500 of seabird restoration funds for the boardwalk replacement.

6. Safety

All of the PRBO Farallon Biologists and the FWS Farallon ROS attended motorboat operators training in 2000. An MSDS file was initiated and PRBO staff briefed on how to read MSDS.

Fire extinguishers were checked in June and December and taken to the mainland for annual recharging per a newly established schedule. The FWS House's smoke alarms were checked and fresh batteries installed in December. An eyewash station was installed in the carp shop and guard rails were installed at East Landing. A wind sock was installed at the helo pad.

Many items described under the Equipment and Facilities (Section I) contributed to improving safety for island personnel.

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*).

A botanist from the National Park Service identified 5 species of mosses during a 1-day September visit. Specimens were taken for the Cal Academy Collection, and they will be included in a San Francisco moss flora publication. The endemic lichen species (*Edrudia constipans*) was found to be quite common around the lighthouse.

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 and vagrants can be found in and around these trees, thus facilitating censusing and banding of these birds.

6. Other Habitats

Two long-awaited habitat management projects were accomplished in September 2000: 1) Reconstruction of walkways (boardwalks) around buildings and mist-netting areas on the Marine Terrace; and 2) Construction of crevice nesting habitat from an old concrete foundation at North

Landing, called the "Habitat Sculpture". The walkways protect borrowing seabird nesting habitat from human trampling, and also create habitat for Cassin's and rhinoceros auklets to nest underneath: specially designed gaps between the boards allow auklets to crawl under the boardwalk.



Telephone Pioneers constructing boardwalk



Finished boardwalk, Joelle Buffa & Pioneers

The Habitat Sculpture was designed, funded, and constructed by Meadowsweet Dairy artists. A concrete foundation, remains of an old building near North Landing, was broken up and the rubble piled to resemble natural nesting habitat. Inside the rubble mound is a stainless steel frame, which provides support and creates a 6-foot square room that serves as a bird blind. There are 32 artificial nesting boxes inserted into the rubble mound, and they each have a plexiglass window in the rear of the box. The habitat sculpture resembles a rock igloo. Biologists crawl into the blind to observe the colonization by birds it was designed to attract: Cassin's and rhinoceros auklets, pigeon guillemots, and ashy storm-petrels. Soil under the former building foundation was also made accessible to burrowing seabirds by the project.



Meadowsweet Dairy constructing habitat sculpture

10. Pest Control

FWS and PRBO and volunteers continued to control exotic vegetation, primarily New Zealand spinach (*Tetragonia tetragonioides*), to prevent encroachment across the Marine Terrace and up Lighthouse Hill. August 18-24 marked the twelfth 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 higher this year compared to last year, but still much reduced from 1998, the year of the unprecedented "El Niño bloom". Approximately 3 times the amount of herbicide (267.5 gallons in 2000 compared to 87.75 gallons in 1999) and 2-1/2 times the person effort (82 person hours in 2000 compared to 35 in 1999) was expended to control non-native plants in this year.

Progress in controlling New Zealand spinach is still evident, despite the increased control effort noted above. The El Niño bloom has been reversed. Few or only immature seeds were present on plants this year, so we continue to reduce the seed bank. In contrast to 1998, no spinach plants were found on the north side of the island.

Control of spinach continued throughout the fall and early winter months due to the diligent efforts of the Farallon ROS, Bart McDermott, who pulled and/or sprayed non-native plants during each of his September, October, November, and December visits.

The control of *Malva* continues to be a challenge. Infestation has been dense and widespread along the cart path, and around the water catchment pad and buildings for the past 3 years. This is despite fall spraying and spring hand-pulling efforts by volunteers. Further investigations are needed to come up with a successful control method. Because its roots are stout and expansive, *Malva* is a concern for burrowing seabirds.

4. 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 islands within the Wilderness Area comprise 141 acres and serve as marine bird and mammal breeding areas. Periodic monitoring by boat or foot is the only management practiced on these islands, therefore the wilderness designation does not affect Refuge operations.

The waters surrounding the Refuge are part of the Gulf of the Farallones National Marine Sanctuary, managed by NOAA, and are a designated State Department of Fish and Game Ecological Reserve. The islands and waters are also part of the Golden Gate Biosphere Reserve.

G. WILDLIFE

2. Endangered and/or Threatened Species

a. American Peregrine Falcon

The peregrine falcon was removed from the Federal Endangered Species List as a threatened species in August 25, 1999. See section G.6.

b. California Brown Pelican

Brown pelican numbers peaked at 2450 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.

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

| Month | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|-----------|------|------|------|------|------|------|------|-----------|------|
| January | 350 | 375 | 208 | 52 | 320 | 475 | 1000 | 700* | 200* |
| February | 28 | 143 | 78 | 0 | N/A | 38 | 525 | 500* | 6 |
| March | 46 | 247 | 26 | 81 | 14 | 0 | 213 | 0 | 65 |
| April | N/A | N/A | N/A | 73 | 7 | 1 | 180 | 0 | 26 |
| May | 130 | N/A | N/A | 14 | 10 | 40 | 455 | 26* | 42 |
| June | N/A | N/A | N/A | 5* | 10 | 386 | 1245 | 41 | 436 |
| July | N/A | N/A | 353 | 464 | 193 | 112 | 300* | 300* | 300* |
| August | 175 | 861 | 409 | 1200 | 456 | 960 | 810 | 500* | 300* |
| September | 402 | 1070 | 940 | 1190 | 819 | 3380 | 2332 | 728* | 1700 |
| October | 1871 | 1049 | 2025 | 1629 | 1670 | 4350 | 2625 | 2700 | 2450 |
| November | 1277 | 3300 | 425 | 1117 | 721 | 3030 | 2360 | 1900 | 663 |
| December | 405 | 1500 | N/A | 392 | 460 | 1500 | 750* | 1000 * | 650 |

* =Average monthly population

N/A= Data not available

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

c. Steller Sea Lion

On December 4, 1990, the Steller sea lion was listed by the National Oceanic and Atmospheric Administration as federally threatened. Steller's sea lions have shown a 50% decline worldwide since the 1960s. A Steller Sea Lion Recovery Plan was issued in October 1991, and the South Farallon Island (SFI) rookery and waters around the Refuge was designated critical habitat in August 1993. Most of the following is based on Hastings and Sydeman (1997).

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, number of sub-adult males increased during the breeding season, and numbers of immatures present during the late fall/early winter increased by approximately 50% 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 the mid-1980's. 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). At SFI during 1990, fewer than 10% of the females gave birth. 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). 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 consisting of flocks of ducks or geese flying by the island after getting lost at sea. A Eurasian Wigeon on 2 September was a second island record. Two American wigeons were noted in November and a green-winged teal was present most of December. Two Aleutian Canada geese, part of a flock of twelve that arrived January 28, stayed through March. In 1993 a black brant arrived on SEFI and has been resident ever since. She was named Molly and feeds among the western gulls on the Marine Terrace and lower slopes of Lighthouse Hill.

4. Marsh and Waterbirds



No marsh or waterbirds breed on the Refuge, however PRBO censuses migratory species daily. A black-crowned night heron was noted on 4 April and a juvenile black-crowned night heron was present for most of the fall. A Virginia rail's appearance on 22 August was particularly well-timed since all Refuge winter rail counters (Joy, Joelle, Diane, and Ivette) were able to confirm its identity. The rail's capture in a mist net near the Carp Shop made a high tide airboat survey unnecessary.

PRBO Volunteer holds Virginia Rail, banded & released.

5. Shorebirds, Gulls, Terns and Allied Species

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).

The Refuge supports a significant proportion of state's breeding population of 10 species: Leach's storm petrel (11%), ashly 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 ashly 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. Fairly large numbers of juvenile sardines were first spotted during fall 1992 in waters around the SEFI, and they have continued their comeback over the past eight years.

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

Productivity of seabirds on SEFI during the 2000 breeding season was higher than the long-term average for all species except western gulls, a result of lower-than-average sea surface temperatures present throughout the breeding season. This is the second highly productive seabird year in a row, following the dismal productivity of the 1998 El Niño year. If ocean conditions are favorable, most seabirds are able to bounce back after a year of low productivity, which is apparent in the 1999 and 2000 breeding seasons.

Breeding population sizes were lower than the 1999 estimate for all species except Cassin's auklet, pelagic cormorants, and pigeon guillemot. The 2000 breeding population sizes for all species (except black oyster catcher) were lower than the average for the previous decade. The boat portion of the census for Brandt's cormorant, pelagic cormorant, and common murre could not be conducted during 2000 due to rough seas.

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). Comparing 1972 and 1992 population estimates shows an overall population decline of 35% and a 40% decline of breeding birds. The 2.87% per year decline roughly equals the observed annual predation by western gulls, as determined by ashy storm-petrel carcasses (approximately 40) found each year. This predation rate on adults of such long lived, slowly reproducing species is considered significant. 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. House mice may be having more serious indirect effects on petrels by enticing owls that predate seabirds to over-winter (Section G.6) A population estimate of ashy storm-petrels more recent than 1992 cannot be made until data from continuing mark/recapture study are analyzed.

Table 2. South Farallon Breeding Seabird Populations

| | 1994 | | 1995 | | 1996 | | 1997 | | 1998 | | 1999 | | 2000 | | 1991-1999 |
|----------------------------------|-------------------|-----------|---------------------|-----------|--------------------|-----------|---------------------|-----------|---------------------|-----------|---------------------|-----------|---------------------|-----------|----------------------------------|
| <u>SPECIES</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>BP</u> | <u>YF</u> | <u>Avg. Breed- ing Pairs</u> |
| Ashy storm-petrel ^{1,2} | 2661 ³ | 0.71 | 2661 ³ | 0.60 | 2661 ³ | 0.53 | 2661 ³ | 0.78 | 2661 ³ | 0.52 | 2661 ³ | 0.74 | 2661 ³ | 0.67 | N/A |
| Double-crested cormorant | 586 | N/A | 462 | N/A | 444 | N/A | 188 ⁵ | N/A | 330 | N/A | 468 | N/A | 402 | N/A | 455 |
| Brandt's cormorant ¹ | 11,740 | 15,560 | 10,630 | 9,940 | 8,074 | 8,437 | 7,490 ⁵ | 7,003 | 5,092 ⁵ | 1,069 | 6,345 ⁵ | 7,614 | 5,896 ⁵ | 6,692 | 7,467 |
| Pelagic cormorant | 570 ⁵ | 170 | 374 | 318 | 374 ⁵ | 47 | 316 ⁵ | 144 | 164 ⁵ | 5 | 222 ⁵ | 141 | 260 ⁵ | 159 | 384 |
| Black oystercatcher | 12 | N/A | 6 | N/A | 12 | 9-27 | 22 | 14 | 18 | 10 | 30 | 26 | 26 | N/A | 18 |
| Western gull ¹ | 21,360 | 9,510 | 24,630 | 11,450 | 20,815 | 5,412 | 23,807 | 7,142 | 19,707 | 5,124 | 19,767 | 3,063 | 15,544 | 4,818 | 20,866 |
| Pigeon guillemot | 944 | 405 | 1,650 | 685 | 728 | 164 | 1,273 | 433 | 294 | 7 | 468 | 267 | 568 | 335 | 867 |
| Common murre | 57,000 | 22,800 | 69,600 ⁶ | 28,290 | 65,400 | 19,293 | 61,089 ⁵ | 24,130 | 52,670 ⁵ | 10,271 | 58,878 ⁵ | 24,082 | 53,301 ⁵ | 21,853 | 59,720 |
| Cassin's auklet ² | 25,325 | 7,851 | 25,325 | 8,610 | 23,668 | 9,586 | 26,892 | 7,395 | 10,458 | 4,131 | 15,239 | 6,324 | 15,239 | 6,324 | 22,146 |
| Rhinoceros auklet ² | +500 | +150 | +1000 ⁴ | +325 | +1000 ⁴ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Tufted puffin | 130 | N/A | 100 | N/A | 92 | N/A | 130 | N/A | 50 | N/A | 118 | N/A | 74 | 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) Estimates are very rough.

(5) Population estimate from land based survey only. No boat survey conducted.

(6) Estimates revised based on Sydeman et al 1997.

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

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 trend, without displaying further drops. Observed declines may be partially due to colonies shifting closer to the mainland. However, shifting colonies cannot totally explain the over 50% decline, so oceanic changes are also suspected as being partially responsible.

Population size of Brandt's Cormorants in 2000 was 7% lower than the estimate for 1999 and 21% lower than the 1990s average (Table 2). The population estimate is based on ground surveys conducted during 2000 plus a correction factor derived from 1994-96 censuses, when complete ground and boat censuses were last conducted. Productivity of the Cormorant Blind colony was very high, with 2.27 fledglings produced per pair, which is 65% higher than the 29-year average (Fig. 1). Mean clutch size was 3.2 eggs per nest and hatching success was 79%. Fledgling success was high, with 95% of the chicks that hatched surviving to fledge.

The **double crested cormorant colony** is located on Maintop on West End. On 6 May, a peak number of 201 well-built nests with birds in incubation posture were counted. Multiplying this count by 2 yields a breeding population of 402 birds. This is slightly lower than the 1990s average (Table 2).

The **pelagic cormorant** breeding population has declined significantly since the early 1970s. The estimated 2000 breeding population of 260 birds was higher than the 1999 count but lower than the 1990s average. Pelagic cormorants produced 1.22 fledglings per pair, which is 59% higher than the 29-year average (Fig. 1). The average clutch size was 2.23 eggs per nest. Hatching success was 50%, and 92% of the chicks that hatched survived to fledge. One pair was successful at raising a second brood.

The **western gull** breeding population size of 15,544 birds was 22% lower than in 1999 and is the lowest value reported in the last 9 years (Table 2). Western gull productivity continued the downward trend observed since the early 80s, and productivity in 2000 was 46% lower than the 29 year average (Fig.1). However, productivity was higher than in 1999, and the highest value recorded since 1995. Causes for the decline are unknown, but changes in prey availability and intra-specific predations are contributing factors. The number of chicks fledged per pair was only 0.62. Out of the 67% of eggs that hatched, only 31% of the chicks survived to fledge. Mean clutch size was slightly higher than in previous years, with 2.86 eggs per nest.

The peak count of 568 **pigeon guillemots** on May 4 was higher than the 1999 count but still low compared to the previous 9 years (Table 2). At Lighthouse Hill and Garbage Gulch, 128 sites were monitored, of which 69 were observed with at least one egg (54% of total monitored sites). Pigeon guillemots produced 1.18 fledglings per pair, which was 51% higher than the 29-year average (Fig. 1). The mean clutch size was 1.57 eggs per nest and 87% of the chicks hatched successfully. Fledging success was also high, with 86% of the chicks surviving to fledge.

The **common murre** population peaked at over 102,000 in 1982, followed by a decline in the mid to late 1980s. This decline was due mainly to the combined effects of gill-net caused mortality, the El Niño Southern Oscillation (ENSO) event, and oil spills. The near shore gill-net fishery was halted in late 1987 due to its significant impact on seabirds (primarily murres) and marine animals. Beginning in the early 1990s the murre population began to recover, but this was interrupted by the 1992 ENSO event. Moderate growth resumed thereafter but the population remains depleted.

A SFI breeding population of 53,301 common murres was estimated from PRBO land-based surveys. A correction factor based on data from 1992-93 and 1995-96 (when boat and land-based surveys were conducted) was applied to this number to account for areas not counted in 2000 in the boat portion. This 2000 breeding population was lower than estimates for 1999 and the 1991-99 average. Preliminary analysis of aerial surveys conducted by USFWS on 6 June came up with breeding population estimates of 97,278 murres for South Farallon Island, and 50,864 murres for North Farallon Islands. These numbers need to be reconciled and may change upon further analysis.

During the 2000 seabird breeding season, 180 common murre sites were monitored daily in the Upper Shubrick Study Plot. The total number of breeding sites (where at least one egg was laid) was 129. Productivity in 2000 was high, with .082 chicks fledged per pair. This figure is 11% higher than the 29-year average of 0.74 (Fig. 1). Hatching and fledging success were both high, with 88% of all the eggs hatching, and 94% of the hatched chicks surviving to fledge.

In the Upper Upper plot under the Cormorant Blind, the number of sites monitored daily was 52, with 31 of those sites attended by a breeding pair. Hatching success at Upper Upper was 94%, although only 66% of these chicks fledged (see Table 2). Productivity was 0.61 chicks fledged per pair.



Photo © Brian O'Neil 2000

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 2000 breeding population was estimated at 15,239 birds, which is lower than the 1990s average and the second lowest ever recorded for SEFI (Table 2).

Over the past 20 years Cassin's auklets have been declining at concerning rates. 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 this year, with 77% of the 44 boxes occupied. Productivity was high, with 0.83 chicks fledged per pair, which is 20% higher than the 29-year average. 79% of the eggs hatched and 85% of these chicks were able to fledge successfully. Six pairs out of 9 attempts were successful at raising 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 55% of 101 monitored sites (boxes, crevices, and cave sites). Auklets produced 0.66 fledglings per pair, which was 20% higher than the 14-year average (Fig. 1). 78% of the chicks successfully hatched, and 93% successfully fledged.

Tufted puffin breeding population was estimated at 74 birds based on the number of occupied breeding sites. This lower average number may be an underestimate because visibility was poor during the June survey. Criteria used for determining site occupancy is two or more sightings of a bird at a site, or one sighting of a bird entering with nesting material. Two new breeding sites were discovered in June 2000.

Black Oystercatcher breeding population is estimated by censusing all known breeding sites visible from Lighthouse Hill, the Marine Terrace, and by boat. 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, 13 were attended by a breeding pair which had eggs and/or chicks. Compared to previous years, this is the highest number recorded since 1991 (Table 2) and is higher than the 8-year average. Based on these 13 breeding sites, black oystercatchers produced 1.25 fledglings per pair. Black oystercatcher nests are cryptic and difficult to observe, therefore clutch size and hatching success could not be estimated.

Oiled Birds: One to four oiled birds were seen during each of the summer and fall months. This is atypical since oiled wildlife are usually spotted during the winter. Oiled birds were only seen in one of the winter months; February, when 8 birds of 3 species were found oiled. PRBO's preliminary analysis of 1997-1994 oiled bird/mammal sightings indicates a significant correlation between stormy weather (especially high swells) and observation of oiled organisms. Subsequent to 1984, this may be related to upwells from the sunken Puerto Rican vessel.

6. Raptors

Two to four peregrine falcons were present throughout the fall and winter months, September through March. Although they do not breed on the Refuge, individual peregrine falcons were periodically observed in April and May. Cassin's auklets and common murrelets at sea near SEFI are primary food sources, based on numerous carcasses found at feeding sites.

Two to five burrowing owls were present September through March, which is typical. PRBO recently analyzed burrowing owl data and found that a total of 271 burrowing owls (an average of 8 per year) arrived on SEFI from 1968 to 2000. A total of 92 of these (average of 3 per year) were recorded as winter residents. Capture, banding, and release studies have shown these to be young-of-the-year birds. They are most likely dispersing juveniles who 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 some of these owls that remain on the island into the spring begin preying on ash-throated petrels. For example, in 1997 two burrowing owls stayed through early May and 49 petrel wings and 16 owl pellets with petrel remains were found outside one owl's crevice. This situation is a concern for both the owl and the petrel, as both are declining species. The number of dead owls found on SEFI increased between 1968 and 2000, indicating that the declining petrel population is unable to support the over-wintering owls.

Other raptors on SEFI are usually limited to a few fall transients, thus the number owls that spent all or part of the winter this year was noteworthy. A long-eared owl and barn owl that arrived in November 1999 departed in mid-January. Two barn owls, flushed from a cave in May, were apparently feeding on Cassin's auklets based on pellet contents and dismembered body parts found in the cave. Another barn owl was flushed from a cave during spinach spraying in August; Cassin's auklet remains were found in its cave as well.

7. Other Migratory Birds

Southeast Farallon Island is a place well known among ornithologists, ecologists, bird watchers and others for the number and diversity of landbirds that show up on the island. Many of these landbirds are common western birds migrating either north or south depending on the time of year. Increasingly, PRBO is concluding that occurrence of fall migrants at SEFI is affected more by summer productivity than by weather patterns. The birds that attract the most attention are the eastern vagrants (primarily juvenile birds), common elsewhere in the country but not normally found on the west coast or in California. On rare occasions, birds from other continents appear

on the island. The vagrants may have defects which cause them to incorrectly migrate northeast to southwest rather than northwest to southeast. Just 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.

A great-tailed grackle was a new species tallied for the island in May, and common grackle, present from mid November through early December, was also a first island record.

Of personal interest was a Lincoln's sparrow with metal leg band # 3111-73454, captured at Coyote Creek Field Station (Santa Clara Co.) On October 8 by Farallon Refuge Manager Joelle Buffa and Don Edwards San Francisco Bay Refuge Manager Clyde Morris. This young-of-the-year sparrow had been banded a few days earlier on SEFI.

9. Marine Mammals

Weekly all-island pinniped censuses 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 population 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. This species' abundance at SFI increased significantly between 1973 and 1994, at an average rate of 6.4% per year. Peak California sea lion abundance was observed following the 1983, 1992, and 1998 El Niño Southerly Oscillation (ENSO) events. Table 4 shows this typical pattern. The average number of California sea lions in 1998 was 4172, compared with an average number of 1,123 in 2000 - a 73% decrease. The decline reflects differences in migration rather than an increase in mortality.

Along the California coast most of California sea lion young are produced south of Point Conception with the Farallons representing the northern breeding limit for the species. Usually not more than a few pups are born on the Refuge each year. A higher than usual number of pups, including 33 in 2000 (Table 3-B), were born over the past three years. This is probably also related to the ENSO.

Table 3.-(A)**MAXIMUM POPULATION NUMBERS (Peak Monthly)**

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|------------------------|---------------|---------------|----------------|---------------|---------------|------------------|-----------------------|---------------|---------------|----------------|
| California Sea Lion | 3770 (Mar) | 4574 (May) | 3883 (July) | 3416 (May) | 4594 (May) | 4303 (Aug) | 4990 (July) | 7837 (Oct) | 5270 (Jan) | 2423 (Sept) |
| Steller Sea Lion | 181 (Aug) | 138 (May) | 118 (Dec) | 187 (Oct) | 138 (June) | 213 (Nov) | 148 (Nov) | 253 (Dec) | 133 (Oct) | 174 (July) |
| Harbor Seal | 178 (June) | 128 (Aug) | 170 (Sept) | 122 (Feb) | 151 (Mar) | 144 (Sep/Oct) | 141 (Sept/ Nov) | 190 (Feb) | 125 (Feb) | 128 (Dec) |
| Northern Elephant Seal | 874 (May) | 911 (May) | 790 (May) | 838 (Apr) | 532 (Apr) | 590 (Jan) | 571 (Nov) | 406 (Jan) | 623 (Nov) | 1019 (Nov) |
| Northern Fur Seal | 2 (Sept) | 9 (Oct) | 3 (Oct) | 2 (Mar) | 3 (Aug) | 10 (Aug-Oct) | 8-12 (Sept) | 4 (Nov) | 22 (Aug) | 13 (Sept) |

TABLE 3.-(B)**NUMBER OF PUPS OR PUPS/WEANERS PRODUCED**

| | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|-------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| California Sea Lion | 1 | 0 | 1 | 2 | 3 | 16 | 0 | 31 | 17 | 33 |
| Steller Sea Lion ¹ | 4 | 5 | 4 | 5 | 5 | 5 | 4 | 10 | 11 | 9 |
| Harbor Seal | N/A | N/A | N/A | N/A | 1 | 1 | 2 | 4 | 2 | 1 |
| Elephant Seal ² | 335/234 | 366/281 | 329/216 | 287/183 | 299/188 | 308/232 | 274/211 | 250/192 | 198/158 | 174/127 |
| N. Fur Seal ³ | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 1 | 3 | 4 |

N/A= Data not available

¹ Maximum numbers of pups observed during any one June/July census.² Number of pups born/number pups weaned³ Number of pups observed during August visit to West End.**NOTE: These numbers are preliminary and may be revised based on future analysis. Do not cite.**

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. In general, 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 2000 was 49 (Table 4). The peak number of Steller sea lions counted during the breeding season was 174 in July (Table 3A). A total of 11 pups were counted this breeding season. Their remote rookery location on West End makes it difficult to monitor reproductive success from land. On July 12 the National Marine Fisheries Service conducted an aerial pinniped survey.

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 128 in November.

TABLE 4. AVERAGE MONTHLY PINNIPED NUMBERS - SOUTH FARALLON ISLAND

| | CA Sea Lion | | | Steller's Sea Lion | | | Harbor Seal | | | Elephant Seal | | | N. Fur Seal | | |
|---------------|-------------|-------|-------|--------------------|------|------|-------------|------|------|---------------|------|------|-------------|------|------|
| | 1998 | 1999 | 2000 | 1998 | 1999 | 2000 | 1998 | 1999 | 2000 | 1998 | 1999 | 2000 | 1998 | 1999 | 2000 |
| JAN | 4500 | 5000 | 800 | 60 | 30 | 30 | 150 | 50 | 90 | 350 | 300 | 200 | 0 | 1 | 2 |
| FEB | 6177 | 2750 | 600 | 52 | 30 | 20 | 87 | 63 | 100 | 214 | 200 | 200 | 0 | 0 | 0 |
| MAR | 1416 | 625 | 222 | 50 | 20 | 16 | 68 | 60 | 75 | 180 | 170 | 95 | 0 | 0 | 0 |
| APR | 2105 | 254 | 501 | 67 | 47 | 27 | 82 | 57 | 83 | 304 | 267 | 330 | 0 | 0 | 0 |
| MAY | 4954 | 600 | 1039 | 53 | 46 | 39 | 84 | 61 | 39 | 326 | 258 | 425 | 0 | 0 | 0 |
| JUNE | 5007 | 5007 | 686 | 11 | 87 | 101 | 110 | 53 | 55 | 200 | 258 | 72 | 0 | 0 | 2 |
| JULY | 5464 | 2124 | 1658 | 37 | 34 | 89 | 76 | 54 | 102 | 18 | 43 | 17 | 1 | 0 | 5 |
| AUG | 4154 | 2000 | 1450 | 32 | 25 | 39 | 98 | 90 | 97 | 51 | 75 | 114 | 7 | 30 | 0 |
| SEPT | 2691 | 1446 | 1929 | 41 | 62 | 50 | 69 | 74 | 47 | 121 | 213 | 322 | 4 | 5 | 11 |
| OCT | 3358 | 1745 | 1815 | 80 | 109 | 54 | 77 | 81 | 69 | 261 | 377 | 772 | 2 | 4 | 4 |
| NOV | 4239 | 1419 | 1529 | 165 | 91 | 91 | 62 | 89 | 63 | 243 | 542 | 763 | 0 | 2 | 1 |
| DEC | 6000 | 1100 | 1250 | 50 | 40 | 35 | 50 | 90 | 120 | 237 | 310 | 375 | 0 | 2 | 1 |
| TOTAL | 50065 | 24070 | 13479 | 698 | 621 | 591 | 1013 | 822 | 940 | 2505 | 3013 | 3685 | 14 | 44 | 26 |
| Avg/Mo | 4172 | 2005 | 1123 | 58 | 51 | 49 | 84 | 68 | 78 | 200 | 251 | 307 | 1 | 4 | 2 |

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

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 one pup was observed this year (Table 3B).

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.

Four 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. The breeding site is not visible from Lighthouse Hill nor boat. Pups can only be monitored by accessing West End on foot in the early fall after seabirds have left their breeding sides.

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 |

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

Elephant seals were also extirpated from the Farallons, but returned in 1959 and began breeding on SFI again in 1972. Elephant seals birth 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 174 births during the 2000 season. Associated with the decline in production, is also a decline in the number of adult bulls and cows (Table 5).

One 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. Numbers of cows using Shell Beach dramatically declined in 1999 and elephant seal breeding activity is now more evenly distributed between SEFI and West End.

Reproductive success of elephant seals was monitored daily at four Southeast Farallon Island sub-colonies and several times a month at the two West End sub-colonies. The first pregnant elephant seal cow of the 1998-1999 season arrived on December 26th, 1999. The first pup of the season was born on January 1, 2000.

Productivity of **SEFI elephant seal** sub-colonies was higher the past two years compared to the previous decade. Some cows, turned away from the eroded West Beach pupping areas, have found their way to Sand Flat. Sand Flat remained the major pupping area of the 4 SEFI sub-colonies. Of the 87 pups born on Sand Flat, 67 survived to be weaned ("weaners"); 5 of 8 pups on Mirounga Beach were weaned. Pups born on North Landing and Garbage Gulch, low wave-swept beaches, are usually washed out to sea, as is true for all 6 pups born at these 2 sub-colonies.

West End elephant seal productivity declined dramatically in 1999. Numbers of cows and pups at the Shell Beach sub colony declined 75-80% from the previous decade. This year (2000) was similar to 1999, with approximately 60 cows producing 44 weaners. The only approach to Sand Flat (which isn't sandy at all) now is at high tides, or by long traverse from a rocky landing some distance away.

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.

Two interesting interactions between elephant seals and western gulls were observed in June. A western gull regurgitated a pink elephant seal tag on June 19. The next day an elephant seal ate a western gull chick that had fallen into Garbage Gulch. The two events were unrelated, but unusual.

43 California sea lions and three elephant seal with debris constricting their necks or other body parts were seen throughout the year. This is similar to "ring-necks" observed during 1999. Materials involved included packing straps, monofilament and salmon lures.

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.

The most notable cetacean event this year was 12-15 orcas observed near the island feeding on a probable white shark near Sugarloaf on November 19. Samples of the orcas meal were collected and sent off for analysis.

Other species observed during 2000 were blue, humpback, Minke and fin whales; Pacific white-sided and common dolphins, and northern right whale dolphins.

11. Fisheries Resources

White sharks were once considered very rare along the California coastline, however in the 1980s shark sightings, captures by commercial fisherman, and shark bites to humans all increased. The main reason for the apparent white shark population increase is probably the tremendous increase in their prey base: elephant seals and California sea lions. The White Shark Protection Bill, which took effect January 1994, prohibits commercial or sport fishing of white sharks within 200 miles of the coast of California.

Observers recorded and photographed/video-taped shark attacks on pinnipeds in waters around SEFI in fall, noting prey taken and location. The study is unique in that shark behavior is observed under natural conditions without baiting or chumming. Individuals sharks can be identified by their appearance and scar pattern. This study was established in 1987.

During 2000, 77 white shark attacks were recorded. The attack frequency for 2000 was the third highest recorded in the 14 years of the study. The prey species were identified during 40 of the 77 attacks and included 3 California sea lions and 37 immature northern elephant seals. An estimated 30-35 different individual white sharks were identified during fall 2000, including many "new" sharks that have not been previously recorded. Colder water temperatures this year may have caused the shark population to shift south, resulting in some sharks occurring in Farallon waters that may normally occur further north in the fall.

White sharks vacated waters around SEFI following the presence and attack of the orca pod on November 18-19 (Section G.9). The reaction of sharks to feeding was the same in 2000 as it was when two orcas attacked and partially consumed a white shark in 1997.

Six sharks were tagged with pop-off satellite transmitters, the second year of this study. Four sharks were tracked for 4-6 months, then moved off shore. One of these traveled to the western coast of Hawaii and the 3 others moved to subtropical waters in the eastern Pacific.

Rockfish have declined in waters surrounding the Farallon Islands during the '90s. This has affected seabird diets as documented through PRBO diet studies. For example, during the '70s and '80s, murrelets ate primarily juvenile rockfish, but switched to anchovies and sardines in the 1990s.

Between 1986 and 1990, commercial abalone and urchin harvesting activity increased by more

than ten-fold in waters surrounding the Refuge and disturbance to wildlife correspondingly increased. In order to reduce and minimize disturbance to nesting seabirds and mammals, the waters within one nautical mile of the Southeast and North Farallon Islands were established as a state of California Ecological Reserve, and the following boating regulations became effective in November 1991 under Section 630 (b) (71), Title 14, California Code of Regulations.

1. Speed limit of five nautical mph within 1000 feet of shore line, year around, at Southeast and North Farallon Islands.
2. Abalone and urchin diving boats will terminate vessel engine and air compressor exhaust system through muffler or below waterline.
3. No boats allowed within 300 feet of most of the shoreline between March 15 and August 15. This includes no boats passing between Saddle Rock and Southeast Farallon Island (SEFI). This closure does not apply to the leeward (east) side of some of the North Farallon Islands, and SEFI from Fisherman's Cove (North Landing area) around the East Landing (including Shubrick Point).

Since May 21, 1997, a moratorium has prohibited the take of abalone for recreational or commercial purposes. The moratorium encompasses all off-shore islands of California. Approximately 23 dive boat days occurred in waters around SEFI during 2000, a 60% decrease compared to 1999.

15. Animal Control

The Refuge and PRBO began conceptual planning for eradicating non-native house mice from SEFI this year because of their adverse affects on the natural ecology (Section G.6). In March, New Zealand rodent eradication expert Dick Veitch visited the island on a day trip. He provided technical advice on how such a project could be approached on SEFI based on his experience implementing over 60 island non-native species control projects. He recommended that aerial application of poisoned bait would be the only effective method, and helped us identify information needs and next steps.

PRBO began gathering baseline information by collecting and analyzing regurgitated owl pellets. Preliminary analyses support our hypothesis that owls feed primarily on mice during the fall, then switch to ashy storm-petrels and Cassin's auklets in spring when mouse populations are low. Refuge Manager Joelle Buffa made a presentation at the Fish and Wildlife Service/National Park Rodent Eradication Workshop in July (San Francisco) entitled, "Planning for a Mouse Eradication on the Farallons." A project proposal for mouse eradication was submitted to the Cape Mohican Trustee Council and was included in their draft oil spill restoration plan.

16. Marking and Banding

Banding and/or color marking of seabirds, landbirds, and elephant seals are conducted on a large scale by PRBO. Approximately 1,820 seabirds and landbirds were banded in 2000. 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, tufted puffin, 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. Two oystercatcher chicks were color banded in 2000. Some individual birds have been followed as nestlings through more than 20 years 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. 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. An unusually high number of gulls were observed dead from botulism during the summer months. At least a dozen per month April through June, and slightly fewer numbers in July.

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 in every month except April, although peak numbers visited in late summer and the fall. A total of 96 sightseeing boats with 3746 people were recorded during the 2000, which is typical of recent years.

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 considered violations. Eight ceiling violations by private planes or helicopters were reported in 2000, which is about average. Two of these were helicopters, which flushed seabirds.

One helicopter (#N811HS) circled the island 4 times at elevations less than 100' on June 19. Since this was at the height of the seabird breeding season, numerous murre, Brandt's cormorants and gulls were flushed from breeding sites. PRBO biologist Kyra Hills immediately reported the violation to Refuge Officer Barry Tarbet who met the helicopter when it landed at Oakland Airport. Three citations for disturbing wildlife were issued to the pilot, who chose to take the case to court. The U.S. Attorney is pursuing additional charges against the owner of the

helicopter, the pilot, and the Japanese film company who chartered the helicopter. The case is pending.

PRBO submits written violation reports to the Refuge. If no wildlife disturbance is caused, Refuge law enforcement officers contact the parties that can be identified to educate them regarding the sensitivity of the Refuge, regulations, and the need to avoid such disturbance. Violators that cause wildlife disturbance are cited.

Seven boat violations occurred during the March 15 to August 15 closure which is about average. None of these caused any wildlife disturbance. The "Patriot" "pay to dive with sharks" tourist boat flushed about 100 California sea lions in September when it came within 100 feet of Indian Head.

I. EQUIPMENT AND FACILITIES

2. **Rehabilitation**

Water System: The following repairs were made to the Refuge's water collection, distribution and purification system: 1) Two rotted support beams underneath the wooden redwood water tank were replaced with new beams; 2) Rusted valves and pipe on the bottom of the tank were replaced with PVC at the same time; 3) Demand pump pressure switch was replaced and the demand pump modified to run off the P-V system; 4) Leak in UV return line repaired, 5) Water meter replaced twice and broke twice; 6) UV bulbs in ozone purifiers replaced in April; 7) Bulb in UV filter replaced in November. The settling tank was cleaned and several small holes inside the concrete tank were patched in August.

During the "1999/2000" rain year (November 1999 - April 2000) 29,830 gallons of water were "harvested" during the collection system's second year of operation. This compares with 38,000 gallons collected last year.

The Denver contaminants office funded an extensive barrage of water tests in June. With one exception, results were non-detectable or below allowable limits for all compounds tested including lead, copper, asbestos, mercury, cyanide, sulfates, fluorides, and organics. Limits were exceeded for nitrate. Water samples continue to be taken 3 times a year and tested by Alameda County for coliform, and continue to test negative.

Moe Burke, our Farallon family plumber, designed a gray water system for the FWS House and supervised its installation in November. The system catches rain water from the roof and gray water from the washing machine, storing it in a 3,000 gallon tank behind the house. Water is used to flush the downstairs toilet, directly from the toilet tank, ending the 5-gallon "bucket brigade." The first real toilet flush on December 15 was cause for celebration.

Residences: Roof shingles began to loosen and/or blow off during high winds this spring on both houses, and two pieces of fascia blew off the FWS house. Inspections by FWS personnel

concluded that specs in last year's major house repair project were not properly followed. Roofing and siding sub-contractors repaired the damage during a 1-day visit in June. Problems with the roof ridge caps coming loose continued until bird deterrent spikes were installed on the roof peaks in December. The spikes now prevent gulls from roosting and loosening the shingles.

Refuge volunteer Brian O'Neil installed and painted interior trim on all of the CG House windows, and completed trimming the FWS House windows, during May.

Powerhouse: RO engineer Monique King and a concrete structure specialist from Conlee Engineers in Portland made a site visit in June to evaluate the structural integrity and develop a remediation plan for the spalling concrete problem on the exterior surface. The overhead powerhouse door was replaced in October after the old one fell off the tracks and smashed into pieces. Sealant was applied to roof areas suspected of causing leaks in the inverter room.

Electric: A new breaker was installed in the boiler room so that the water heater and UV filter are on separate breakers. Five additional corroded couplings on the 3" electrical conduit that runs between the Powerhouse and East Landing derrick were replaced with stainless steel repair sleeves.

Other: Several sections of railway were replaced with stainless steel pipe.

4. Equipment Utilization and Replacement

East Landing Derrick: Fewer problems were encountered this year compared to most. Loud groaning, which seemed to be coming from the bull wheel or base of the mast, occurred intermittently most of the year, despite greasing and changing of zerk fittings. It seemed to stop after the 2 mast sheaves were changed and oil added to the slewing thruster motor in October. The lower portion of the mast was painted in April.

Generators/Fuel: The Listers were also uncharacteristically problem free. Repairs and modifications included: 1) New fuel line bulkhead installed on the Lister day tank; 2) Racor fuel pre-filters replaced the canister filters; 3) A meter installed on the diesel fuel dispensing pump

Outboard Motors/Boats: The Johnson 25 hp motor, which spent a week underwater last year, continued to be a problem. Repairs were made to it and other motors by island and FWS personnel. A new plastic boat box was purchased and rigged for transferring gear from the Whaler to the landing. PRBO received an 18' Zodiac and 50 hp engine from a donor to use for VIP trips. It was brought out in August and will remain until the winter.

6. Energy Conservation

March marked the 2-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 4,000 gallons of diesel fuel during its 2nd year of operation. Fuel consumption

during the 2nd year increased to 950 gallons of diesel (compared to 600 gallons used during the first year). Increased fuel consumption was due to the diesel-burning house hot water/space heating system (Webasto), which was fully functional this year. The Webasto uses 0.35 gallons of diesel per hour, and the SOPs result in an average of 3 gallons/diesel per day to operate during the coldest months, less during the summer and fall.

The solar system continues to receive accolades. The Refuge received a Certificate of Appreciation from the EPA for "demonstrating federal leadership on Earth Day 2000." Refuge Manager Joelle Buffa gave an invited paper entitled, "Converting an Island to Solar Power: A Case Study in the Pacific" at the World Energy Engineering Congress in Atlanta in October.

Applied Power made minor adjustments to the P-V system by during their annual service visit in February including: 1) Equalizing the batteries; 2) Repairing connections in the solar array wires; and 3) Removing deteriorated bird spikes. Nora Rojek (of the Common Murre project) installed new bird spikes in April. An automatic battery watering cart was purchased, which solved the overfilling problems.

7. Other

A unique and major mobilization effort took place on August 23, culminating over a year of planning and involving numerous partners. Approximately 26,000 pounds of materials for various projects were transported onto the island, and 13,100 of metal scrap and other accumulated debris were transported off the island in a carefully orchestrated boat and helicopter transfer. The LCM vessel *Allied Mariner*, skippered by Tim Parker, was loaded at the Corps of Engineers debris dock in Sausalito, motored out to the island and tied up at East Landing. A heavy-lift Sikorski helicopter, contracted from Aris in San Jose, flew out to the island and transferred the following cargo from boat to land (and vice-versa) in about 25 "picks:" 1) Steel frame and concrete for the Meadowsweet Habitat Sculpture, 2) boardwalk materials; 3) garage door; 4) 3000 gallon plastic water tank for the gray water system; and 5) 12 cargo nets and 5 bundles of metal scrap/debris were loaded onto the boat and brought back to the mainland for disposal. The operation followed OAS guidelines for helicopter charter, with National Park Service providing 2 helicopter managers from Point Reyes National Seashore.

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 February, Admiral Collins and Commander Sullivan toured the island with FWS staff Mike Spear, Marge Kolar, and Joelle Buffa to identify items the Coast Guard would remove when they relinquish their claim on the island. The Admiral backed up his pledge to remove abandoned CG

items by sending two teams to the island: In February CG personnel assessed the safety of the North Landing boom and yellow diesel storage tanks and determined they should be removed. In April 9 CG personnel removed small items from the Powerhouse and Lighthouse, and a leaking transformer from the N. Landing boathouse. Admiral Collins was replaced by Admiral Loy in May, but interest in the project was maintained by CG Environmental Specialist Roy Clark. Roy secured the cultural/historical and endangered species clearances to remove the North Landing boom, diesel tanks and excess pipe. However, removal will depend upon funding.

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. The Patrol runs are organized by a commandant and PRBO. Long standing patrol skipper Bill Frazer was presented with the first "Farallon Outstanding Service Award" by Refuge Manager Joelle Buffa at the annual Patrol dinner. The award recognized Bill's help with the house heating system and solar conversion.

The Farallon Islands Foundation, oversees an endowment fund that assists with projects on the Farallons and other islands. This year they provided manpower and funding to remove metal scrap piled behind the powerhouse, purchased materials for the boardwalk, and gray water system.

The Telephone Pioneers, a volunteer organization associated with the Pacific Bell telephone company, constructed approximately 800 feet of boardwalk in September. The walkways were built from recycled plastic lumber and replaced deteriorate wooden walkways around the buildings and bird netting areas on the Marine Terrace. The project involved multiple partners, including the Apex-Houston Trustee Council, UC Berkeley Seismology Lab, San Francisco Wildlife Society, and the Farallon Islands Foundations who provided funds for materials and transportation.

Meadowsweet Dairy, a group of artists led by long-time Farallon supporter Henry Corning, designed and constructed the Habitat Sculpture at North Landing in September. A grant from the Haas Foundation, which funds community art projects, funded the work.

2. Items of Interest

A Time Magazine reporter visited the island for one day in October to collect information to write an article on sharks

The National Weather Service (NWS) removed their recently installed automated weather station atop Lighthouse Hill in October for reasons not fully explained. They will go back to using the weather devices on the Marine Terrace, which PRBO reads and calls in to NWS.

3. Credits

This narrative was written by Joelle Buffa. The typing was accomplished by Brian Barreto.

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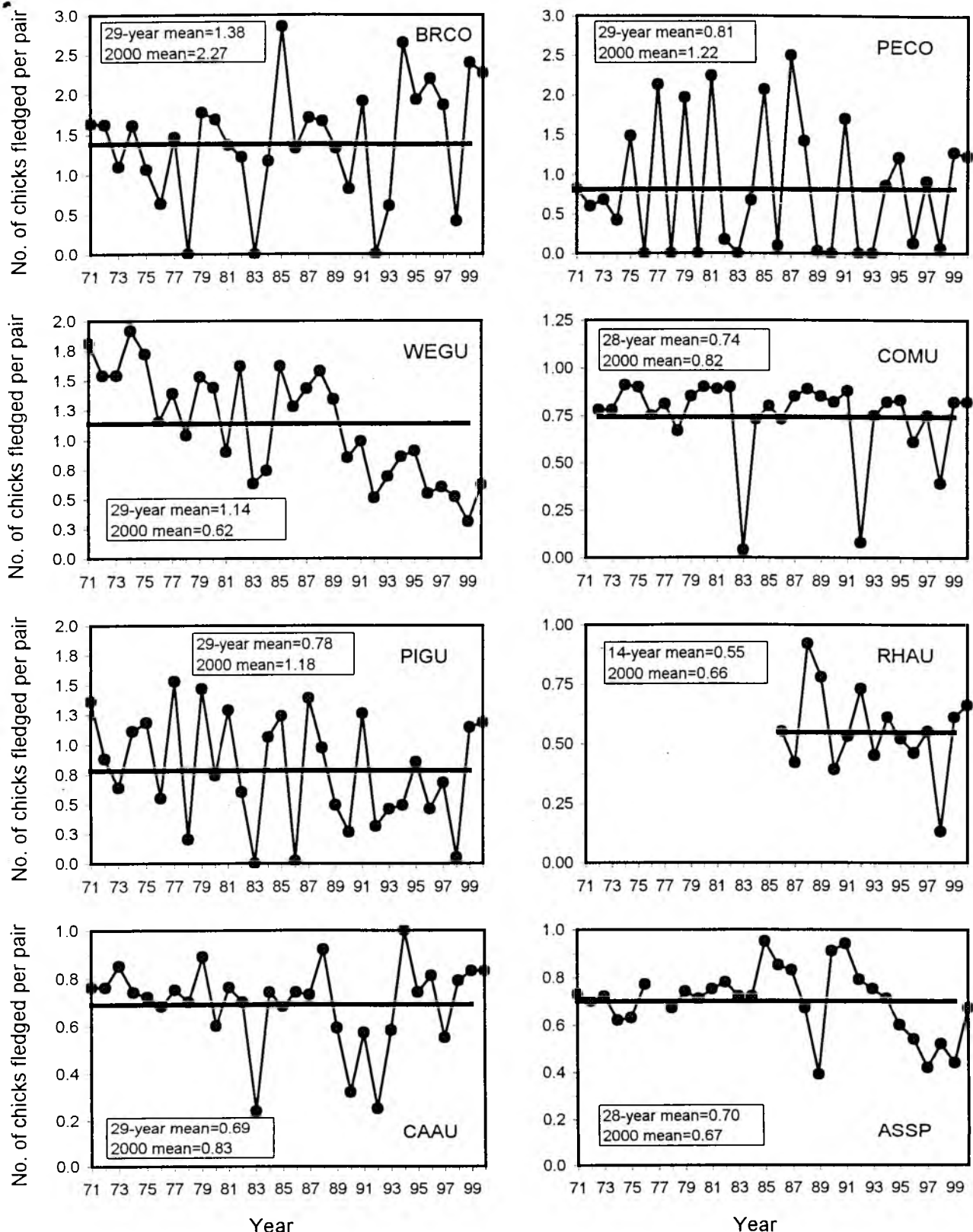


Fig. 1. Productivity of 8 species of seabirds on Southeast Farallon Island, 1971-2000. Productivity is measured as number of chicks fledged per breeding pair (includes first attempts, relays and second broods). The bold horizontal line indicates mean productivity from all attempts between 1971 and 1999. Please note the different scales on the y-axis.

Figure 2



August Helicopter/Barge Mobilization Effort transported 26,000 lbs. of construction materials to Southeast Farallon Island and off-lifted 13,100 lbs. of metal scrap.



Aris helicopter lifting habitat sculpture from Allied Mariner

Aris helicopter pauses for re-fueling (fuel is on spill-proof pallet)



Biologists (clockwise) Ivette Loreda, Diane Kodama, Joy Albertson, Joelle Buffa (AKA "Team Spinach 2000") take a break from spraying New Zealand spinach to package metal scrap.

SAN PABLO BAY NATIONAL WILDLIFE REFUGE

Napa, Solano and Sonoma Counties, California

ANNUAL NARRATIVE REPORT

Calendar Year 2000

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

SAN PABLO BAY NATIONAL WILDLIFE REFUGE

Napa, Solano and Sonoma Counties, California

ANNUAL NARRATIVE REPORT

Calendar Year 2000

Bryan R. Winton

Refuge Manager

June 18, 2002

Date

Refuge Complex Manager

Date

INTRODUCTION

San Pablo Bay National Wildlife Refuge is located in northern San Francisco Bay and comprises shallow open water habitat, mud flat, pickleweed tidal marsh, management wetlands, seasonal wetlands, and uplands. Species benefitting from this refuge, established in 1970, include many hundreds of thousands of migratory birds (canvasback, scaup, waterfowl, and shorebirds). Resident species include the endangered salt marsh harvest mouse and California clapper rail. Other species of concern include California black rails, Suisun shrew, and several anadromous fish species. Raptors are common year-around.

The refuge includes 13,190 acres of vital habitat in a highly urbanized region. Northern San Francisco Bay (San Pablo Bay) includes the majority of the remaining 15% of wetlands originally found in the greater Bay Area. San Pablo Bay consists of salt ponds, agriculture fields and wetlands, managed by the Refuge and California Department of Fish & Game, Napa-Sonoma Marshes Wildlife Area.

Highway 37 is a two-lane highway that bisects the majority of the refuge, offering a spectacular view of the wide open space that can now only be found in northern California. Tolay Creek is open to public access 7 days a week, sunrise to sunset. This public use area can be accessed via Highway 37—9 miles west of Vallejo, and 0.5 miles east of HW121/37 junction (Sears Point). Mare Island and Skaggs Island are former Navy lands the Refuge is currently negotiating for and will increase the acreage of the refuge by 40% once these lands are added.

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A. HIGHLIGHTS

San Pablo Bay National Wildlife Refuge entered the new century as a 26-year veteran refuge, with a new Refuge Manager, Bryan Winton. Bryan and Louise Vicencio, Wildlife Biologist and Vallejo native joined efforts to address continuing issues including the Tolay Creek tidal restoration project, headquarters relocation and intern housing efforts, federal lands transfer issues on Mare and Skaggs Islands, Station Brochure development, Tubbs Island Levee Setback construction (Phase I; including \$150K from NAWCA), Cullinan Ranch tree, pump, and buildings removal projects and tidal restoration planning, Figueras Unit flood debris cleanup project, Marin Baylands NWR Public Scoping meeting, administration/management of the Marin Island NWR and professional photography by David Sanger, annual volunteer appreciation pot-luck and open house, main refuge-file inventory and reorganization, Building 505 facility/ground improvements, and continued efforts to improve coordination with Mosquito Abatement Districts, Ducks Unlimited, Inc., Pacific Gas & Electric, California Department of Fish & Game (inter-agency MOU), Caltrans (Cooperative Agreement for acceptance of 53-acre Guadalcanal Village), Grant-writing researchers, farmers, and other non-profit/federal environmental organizations involved with the Refuge.

Fran McTamaneay, Environmental Education Coordinator for the Complex continued to revise the Mare Island marsh manual used to educate teachers and students and continued to lead outreach efforts for the Refuge. The program prospered thanks to the assistance of Carrie Tieken, Cara Rancourt and Cecilia Rejas, Student Conservation Association interns hired to keep the outreach and education efforts ongoing. Fran and interns were especially important in the planning, preparation, and hosting of the 4th Annual Northern San Francisco Bay Flyway Festival in January 2000. Jim Griffin, Complex Maintenance Worker lead the headquarters relocation/renovation efforts for the Refuge. Juan Flores and Art Chan also assisted in April-July during initial arrival of the new office trailers.

All in all, San Pablo Bay National Wildlife Refuge made good progress in the year 2000. The right combination of personalities and work ethics made for a very productive year. In addition to the major projects listed above, the Refuge made progress in landscaping the grounds surrounding Bldg 505, the home of the future wildlife discovery center, and attracting a reliable volunteer, Jim Millholland, Vallejo resident committed to working with the Refuge. Jim helped with the office relocation effort, mowing roads and levees on Mare Island, Figueras and Lower Tubbs Island Units and helped improve Bldg 505 aesthetics. A continued co-location of Fish and Wildlife Service staff from the refuge (3), Ecological Services (2), Migratory Birds (1), and U.S. Geological Survey, San Francisco Estuary Field Station staff (5) benefitted the Refuge and all programs by maintaining an accessible forum for discussions on management and research.

B. CLIMATE CONDITIONS

See Appendices or for climatological data in 2000 see the following internet address:
<http://lwf.ncdc.noaa.gov/servlets/ACS>

This website can provide climatological conditions for many sites encompassing the San Francisco Bay region for the year 2000.

C. LAND ACQUISITION

1. Fee Title

Land acquisition efforts for San Pablo Bay National Wildlife Refuge included appraisals for 3 of 8 houses along the northwest bank of Tolay Creek near Sears Point (HW 37/121). Realty appraisals were made for the 3 houses after a Refuge boundary expansion (~650 acres) was approved, although delays in acquisition were ultimately realized. Federal lands transfer negotiations between the U.S. Department of Defense (Navy) and U.S. Fish & Wildlife Service for Mare Island and Skaggs Island made progress, as did negotiations between State Lands Commission and the Service for ~3500 acres west of the Joy Survey Line on Mare Island to be added under long-term lease (all no-fee additions). However, no finalization of these transfers were made in year 2000.

Approval of a Cooperative Agreement between California Department of Transportation (Caltrans) and U.S. Fish & Wildlife Service, San Pablo Bay NWR was finalized regarding the Guadalcanal Village Unit mitigation project (~53 acres). San Pablo Bay NWR agreed to accept the property into the Refuge after 8 years of mitigation criteria are determined to be satisfied along with \$150K for management and monitoring to be provided by Caltrans. The Guadalcanal Village unit will be added to the Refuge in 2009 if mitigation criteria are satisfied and the Refuge boundary is once again expanded.

3. Other

The U.S. Fish and Wildlife Service, San Pablo Bay NWR continued open communications with State of California Lands Commission (Dave Plummer and Blake Stevenson) to finalize negotiations for the addition of ~3500 acres into the Refuge under long-term lease. These additional lands are located west of the Joy Survey line on Mare Island and include former dredge ponds, tidal marsh, mudflats and open water. Of the 13,190 acres currently managed by the Refuge, 11,200 acres are managed under long-term lease (66 years) from the State Lands Commission. Future long-term leases will be reduced to 50 years under SLC revised policy.

California Department of Fish & Game acquired the State Lands Commission parcel west of Skaggs Island road, immediately north of HW 37. The parcel had been included in the approved boundary of San Pablo Bay NWR. The property is very shallow muted tidal waters that continually supports a wide variety of shorebirds and dabbling ducks. This acquisition by the State demonstrated the continued effort by both agencies to add lands into public ownership in northern San Francisco Bay, Napa-Sonoma Marshes, Sonoma and Solano Counties. California Department of Fish & Game also transferred public access easement holdings on Cullinan Ranch to the Refuge.

Willing landowners for north San Pablo baylands include farmers Fred Dickson and Bob Kiser (Camp 3) and Duck Club owner Bud Dietjen. However, appraisals for these properties have been far below south bay prices since highest and best uses are farmland and wetlands (no infrastructure to support development is currently available). Jim Haire, Skaggs Island farmer as well as others would likely be willing to sell if prices were significantly higher.

D. PLANNING

3. Public Participation

The Refuge Improvement Act of 1997 identified that all public use opportunities first must be determined to be appropriate and compatible and that wildlife-dependent uses will receive the highest consideration on Refuges. All existing and proposed uses will be subjected to Public review in 2001 (prior to 2003 CCP).

The Refuge initiated planning to determine future public use activities in proximity to Building 505 on Mare Island. Due to public safety, trails will likely be confined to existing maintenance roads and passable trails along levee tops.

A major rehabilitation effort was made in attempt to improve Refuge and future public access along the west levee separating the Figueras Unit from State tidelands north of Mare Island and south of HW 37. This Unit will offer outstanding birding opportunities to the public in the interim until decisions are made as to how to contour the 3 dredge ponds to be transferred from the Navy and State Lands Commission. Planning was initiated to evaluate further partitioning of the dredge ponds and what water management options will be allowed to improve conditions for resident and migratory wildlife. Questions such as whether the refuge will be limited to rainfall dependent water management or will there be opportunity to re-partition, recontour, and facilitate pumping tidal waters during winter to provide a range of salinities and depths to attract a wider host of species? Many of these questions do not presently have answers and hinge on State EPA (DTSC, Chip Gribble), Ecological Services, and Navy cleanup issues, as well as fresh and tidal water options yet to be identified.

California Conservation Corps crews spent 1,440 hours collecting and organizing piles of wooden debris (flotsam) deposited on the Figueras Unit levee (~1 mile). This effort will facilitate the improvement of a future public use trail and allow for safe Refuge accessibility for conducting biological inventory along the unit. Before removal, the piles provided ideal conditions for bird and nest predators including rats, snakes, skunks, racoons and foxes. The cleanup effort demonstrated an outstanding cooperative effort to improve access to the public for future birding opportunities. Funding for this effort was made available as a result of a FY98 Flood Damages account.

4. Compliance with Environmental Mandates

Three metal hazardous materials storage containers were donated to the Refuge by the U.S. Navy. Employee, Sue Young, while in charge of clearing out all equipment and office materials in south Mare Island warehouses, contacted the Refuge to notify and offer the approved Environmental Containers and several other metal cabinets.

5. Research and Investigations

Ongoing research projects continued in 2000 with U.S. Geological Survey, San Francisco Bay Estuary Field Station personnel lead by Dr. John Y. Takekawa. Research projects included baseline monitoring of the Tolay Creek, Cullinan Ranch, and Guadalcanal Units. Research of Canvasback and Scaup (waterfowl) telemetry studies to identify contaminant sources, and salt pond studies in the Napa-Sonoma Marshes Wildlife Area included mistnetting dowitchers to identify use and movements by these rarely-studied 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. Other investigations included studies in waterfowl disturbance and effectiveness of bird hazing-devices in relation to their benefit to oil spill response crews.

San Pablo Bay NWR Wildlife Biologist Louise Vicencio continued to oversee baseline monitoring of wildlife populations on Tolay Creek, Tubbs Island, Levee Setback site, Cullinan Ranch, Skaggs Island and Mare Islands with the assistance of several cooperators including USGS.

University researchers included University of California, Hayward and Davis campuses; Point Reyes Bird Observatory, Audubon Canyon Ranch, Ducks Unlimited, ECorp Consulting, California Department of Fish & Game, and Caltrans. A raptor die-off involving more than 100 birds of prey, predominantly immature red-tailed hawks, was investigated by Service Law Enforcement Bob Snow and Ecological Services Contaminant Biologist, John Henderson. The area of concentration was primarily Skaggs Island north of HW 37 but included surrounding/adjacent farmlands. Lab analyses did not identify cause of death except for emaciation and bacteria. Louise Vicencio, Wildlife Biologist assisted with numerous searches.

San Pablo Bay NWR Refuge Manager Bryan Winton initiated a wildlife mortality investigation

in December 1999 for species observed dead along a 9-mile segment of Highway 37 between north gate of Mare Island and Sears Point Raceway. This 9-mile stretch of highway intersects 3 fairly distinct ecotones including seasonal wetlands/tidal marsh; salt ponds/tidal marsh; and agriculture fields--all of which are or will likely be included as part of the Refuge or Napa-Sonoma Marshes Wildlife Area in the future. Species counts were conducted twice monthly to assess relative abundance of species negatively impacted by the 28-30,000 vehicles traversing the road daily. Preliminary results suggest that wildlife mortality from vehicles has resulted in approximately 60% birds and 40% mammals. In addition, considerably more wildlife are killed along the northern, westbound lane than the eastbound lane. Additional focuses of the study will be developed with Louise Vicencio and John Takekawa to assess annual mortality by species and to correlate observed wildlife mortality on the highway with the status of those same species in adjacent areas. Chuck Morton, Caltrans has been very interested and helpful by providing demographic data to support the study. Implications of the study will be presented at the 8th Annual The Wildlife Society meeting in Reno/Tahoe in 2001 and in a technical report or scientific journal.

Bridgett Sousa, Refuge Volunteer, Vallejo resident and UC Berkeley student, is collecting barn owl (raptor) pellets on Mare Island and on other areas of the Refuge as part of an independent study of the diet analysis of these nocturnal birds of prey.

E. ADMINISTRATION

1. Personnel

San Pablo Bay NWR full-time staff included Bryan Winton, new Refuge Manager, transferring from the Lower Rio Grande Valley National Wildlife Refuge Complex in Alamo, Texas. Bryan brings nearly 25 years of wildlife management experience to the job including studies in furbearer trapping, green sea turtles, spotted owls, barred owls, great-horned owls, snowy plovers, least terns, American avocets, and heron and egret research experiences. Bryan has 11 years with the U.S. Government including time in the U.S. Marine Corps, National Marine Fisheries Service, National Park Service, Cooperative Fish & Wildlife Research Unit (U.S. Geological Survey), and U.S. Fish & Wildlife Service (4 years).

Louise A. Vicencio, Wildlife Biologist and Vallejo native has over 15 years with the U.S. Fish & Wildlife Service and served as Refuge Manager (Acting) following the departure of former manager Betsy Couch Radtke. Louise is often cited in waterfowl studies of San Francisco Bay due to her comprehensive waterfowl censusing efforts conducted in the late 1980's. Louise is the leading authority for the Refuge on environmental compliance, habitat restoration, and biological monitoring. Louise is also very skilled in handling management issues and continues to perform in this capacity as a dual function. Louise worked at Nisqually NWR in northern Washington for several years prior to returning to her home town several years ago.

Fran McTamaney, Environmental Education Coordinator for the San Francisco Bay National Wildlife Refuge Complex was assigned part-time to the Refuge to organize, oversee, and improve and expand the environmental education and outreach efforts for the San Pablo Bay NWR. Recent accomplishments include establishment and revision of "In the Marsh on Mare Island" a teacher curriculum developed to expand interest and awareness of the natural resources and environment of northern San Pablo Bay. This guide is provided at teacher-trainings organized by Fran to provide information to teachers so they can take this knowledge back to the classroom (K-6). Fran has been instrumental in promoting the Refuge via the annual Northern San Francisco Bay Flyway Festival held and hosted by the Refuge during the past 4 years. Fran's efforts and dedication are the Refuge's life-link to the City of Vallejo and surrounding communities to increase awareness of natural resources.

Fran McTamaney hired 3 Student Conservation Association interns annually. The SCA interns work on a 3-month rotation to help administer and conduct the teacher trainings and field trips for Fran McTamaney, Environmental Education Coordinator for the Complex.

Student Conservation Association interns have included:

- Shannon Toye, Massachusetts (Sept-Dec 1999; returned for Flyway Festival in January 2000)
- Carrie Teiken, Illinois (Jan-Mar 2000)
- Cara Rancourt, New Hampshire (Apr-Jun 2000)
- Cecilia Rejas, San Francisco (Sept-Dec 2000)
- Stephanie Miller, Kansas (Jan-Mar 2001)

Time and attendance, budget approvals, and several monthly bills are handled from the Complex administrative personnel. Cindy Lu, budget analyst and administration personnel supervisor quickly found herself as the lead contact for budget and administrative issues for the Complex. Cindy has been a tremendous help in insuring the Refuge meets it's budgetary requirements and obligations. Kudos to Cindy on behalf of San Pablo Bay NWR. In addition, thanks to Andrea Carminer, new Administrative Assistant for her help with training information, time and attendance and GSA orders.

3. Other Manpower Programs

California Conservation Corps assisted with volunteering to assist with the 4th annual Flyway Festival by overseeing parking for the Refuge. In addition, the Refuge contracted for three weeks with CCC to do flood debris cleanup on the Figueras Unit of San Pablo Bay NWR. The Refuge hopes to continue to build on the positive relations with this valuable State Conservation program.

California Coastal Cleanup assisted, thanks to the organization and leadership of Louise Vicencio, in cleaning up a significant portion of the Refuge in September 2000. Louise, refuge volunteers, and the SCA intern coordinated to oversee the cleanup effort on Mare Island and Tolay Creek.

Caltrans Biologist, Chuck Morton continues to be a major supporter to the San Pablo Bay NWR. Chuck worked closely with the refuge coordinating projects on and adjacent to Refuge lands and offering technical assistance and aerial photographs. Chuck has also agreed to cooperate on the wildlife mortality investigation along HW 37 initiated by Bryan Winton, Refuge Manager.

4. Volunteer Programs

The San Pablo Bay NWR Volunteer Program benefitted in 2000 from the arrival of Complex Volunteer Coordinator, James Aliberti. James assisted in many ways: 1) coordinating volunteers, 2) providing interpretive information (large scale San Francisco Bay NWR Complex map), 3) providing community service volunteers to the Refuge, 4) providing the Refuge with native plants for landscape efforts at Bldg 505., and 5) providing volunteer training. Myrna Hayes, Flyway Festival co-coordinator continued to organize the annual festival on the grounds soon to be added to the Refuge.

New volunteer, Jim Millholland, 66, Marine Corps veteran and long-time Vallejo resident approached the Refuge to make himself available on average 20-30 hours a week since mid-year. Jim served as an extra employee in many capacities assisting with landscaping, facilities improvements, tractor mowing, and supervision of CCC during flood debris cleanup. Jim continues to be a major asset to the Refuge due to his dedication and willingness to work as a team to meet common objectives. The improved appearance of the new offices, Building 505, surrounding levee roads on Mare Island, and maintenance mowing of Lower Tubbs Island are all primarily a result of Jim's ability and willingness to take initiative to accomplish the task. Jim Millholland and Refuge Manager, Bryan Winton spent numerous weekends "doing the fun stuff" at the Refuge.

Tony Batiste, Refuge volunteer provided numerous professional photographs from his collection of wildlife shots to be considered for inclusion into the new San Pablo Bay NWR general brochure. In addition, Tony contributed a framed photograph of a canvasback duck now located just inside the Refuge entrance.

Tyler Winton, son of Refuge Manager Bryan Winton, assisted with numerous projects during weekends, particularly painting of the new headquarters to match Building 505.

Volunteerism continued to help provide the labor force and backbone of the Refuge, increasing our ability to make accomplishments.

5. Funding

Funding support for San Pablo Bay NWR was substantial in 2000 due to the high-priority headquarters relocation issue. While the Refuge competes with 6 other refuges in the Bay area (all part of the San Francisco Bay NWR Complex), the Refuge received a significant share of

funding support for the relocation effort.

Special funds acquired from natural resource disasters (flood) and Shell Oil Spill Trustee Council were used to repair damages associated with the Tolay Creek tidal restoration project, advance Cullinan Ranch planning, conduct Figueras Unit flood debris cleanup, and construct the new levee (Phase I) at the setback site east of Lower Tubbs Island. Special funds are the key source of revenue for the Refuge to continue to advance on large-scale habitat restoration projects. Non-profit supporters, local advocates, and congressional support have been the Refuge's ticket to success in recent years. Funds from natural disasters (floods and oil spills) continue to provide the bulk of the funds needed to accomplish Refuge projects.

Natural Resource Damage Assessments from a Richmond, California contamination site identified Lower Tubbs Island (Levee Setback Site) as the preferred restoration site to offset the damages found in Richmond. The United Heckathorn funds (~\$400K) will be used to complete Phase II of the Levee Setback 72-acre tidal restoration project.

North American Waterfowl Conservation Association (NAWCA) funds totalling over \$1M were presented in a grant to the Wildlife Conservation Board (WCB) to fund State and Federal wetland projects in northern San Francisco Bay. Cullinan Ranch, Tolay Creek, and Tubbs Island lands were included to justify \$150K in funding to support Phase I of the Levee Setback 72-acre tidal restoration project.

Roger Wong, San Luis NWR Fire Management Officer provided fire funds to be used to upgrade fire management equipment and materials for the San Francisco Bay NWR Complex. These funds were sufficient to include purchase of an all-terrain vehicle to be used to apply herbicides to curtail invasive species and to assist with future prescribed fire exercises.

6. Safety

Only one safety-related injury was realized at San Pablo Bay NWR in 2000. This consisted of a twisted ankle to Environmental Education Coordinator Fran McTamaney at the Mesa Road Headquarters early in the year. An unlevel sidewalk was identified as the culprit.

Safety improvements were made to improve on storage of paints, fuels, and hazardous chemicals (herbicide). Safety (MSDS) sheets were reviewed and are currently under revision. Fire extinguishers for the Refuge received their annual checks. The new temporary offices (HQ) in the trailers included installation of a communications alarm system. Maintenance Worker, Jim Griffin installed exterior lighting atop Building 505 and along the new temporary offices to improve night-time visibility and staff safety.

7. Technical Assistance

San Pablo Bay NWR continues to rely heavily on other programs (both Federal and non-profit) for key aspects of wildlife monitoring and habitat protection/restoration efforts. The Refuge has partnered with Ducks Unlimited Inc. to accomplish restoration projects at Tolay Creek (Tubbs Island/Levee Setback) and Cullinan Ranch.

8. Other Items

Refuge Manager, Bryan Winton attended all Supervisory Staff Meetings at the Fremont headquarters except for 2 in 2000. These meetings were held by Project Leader, Marge Kolar every 2 weeks. Bryan did one meeting by conference call and missed a second because of birth of his second child, Mary Grace on October 10, 2000. Supervisory Staff Meetings provide a forum for all assistant Refuge Managers for the Complex to meet and discuss specifics on Refuge issues.

Refuge Manager, Bryan Winton reorganized the San Pablo Bay NWR filing system (about 15 drawers). New color-coded file covers will help in organization and relocating future documents (we hope). The purpose of the effort was to increase an understanding of the Refuge history. One item worth noting was that several forms of correspondence were undated complicating the organizational effort. Louise Vicencio, Acting Refuge Manager in 1999 and Wildlife Biologist, assisted with the effort by integrating personal files into the Refuge files. This organizational effort is ongoing.

F. HABITAT MANAGEMENT

1. General

San Pablo Bay NWR is involved in several tidal marsh-wetland habitat restoration projects. Tolay Creek, a 435-acre restoration efforts was initiated in December 1998. Although several unanticipated issues have since been realized, the restoration is proving to be an overwhelming success as plant and biological resources have quickly colonized the improved system. Planning for a 1,493-acre tidal restoration of Cullinan Ranch Unit is underway with assistance of Pete Bontadelli, formerly of California Department of Fish & Game, now associated as a contract employee of Ducks Unlimited. Progress is being made for this project. Facilities including the eucalyptus trees, water pump and house, and the wooden buildings and barn were removed in 2000. Remaining issues include reinforcement of the PGE towers (5) located in the northwest corner of the property and removal of the metal pole building (hay barn), and fund raising. Project costs have dramatically increased with the realization of the need to protect the highway and adjacent property owners. Louise Vicencio leads the effort to assemble permits and documentation to conduct the tidal marsh restoration effort for the Refuge. Phase I of the Levee Setback 72-acre tidal marsh restoration project was initiated in November 2000. Phase I included construction of a 2000 foot levee with bench, raising of the levee/road between the

Setback site and Lower Tubbs Island muted marsh, and improvements to 2200 feet of eroded levee associated with the upper impoundment of the Tolay Creek project and installation of erosion-reducing fabric.

2. Wetlands

San Pablo Bay National Wildlife Refuge is located in the northern part of the San Francisco Bay estuary, one of largest and ecologically significant estuaries on the Pacific west coast. Tidal marshes are a critical-type on the Refuge. Management includes restoration efforts on three tidal marsh restoration projects; Tolay Creek, Tubbs Island Setback Levee and Cullinan Ranch. The habitats on San Pablo Bay NWR include open water, mud flats, seasonal wetlands, dampened tidal marshes, and fully functional tidal marsh.

The Refuge consists primarily of open bay and intertidal waters bordered by a large strip of salt marsh south of Highway 37. It also includes 3 miles of tidal creek and a large 1,500 acre parcel of diked historic bayland to be restored to tidal marsh. Future wetlands will include revitalization of three former dredge disposal ponds on Mare Island after they are acquired from the Navy or State Lands Commission.

Open Bay : Waters within the Refuge are a mix of salt water from the Pacific and fresh water from the San Joaquin, Sacramento, Napa, Sonoma, and Petaluma rivers. The open bay waters provide important resting, feeding and wintering habitat for millions of waterfowl, shorebirds and other waterbirds between the fall and spring. The Bay supports a rich aquatic fauna including estuarine fish and invertebrates.

Intertidal Mudflats and Tidal Sloughs: San Pablo Bay is a shallow bay comprised primarily of waters <6 feet deep. This is a result of huge volumes of sediment from the hydraulic gold-mining of the Sierra Nevada mountains in the mid 1800s, that were deposited in San Pablo Bay. The Refuge encompasses an extensive mudflat exposed at low tide extending from its westernmost boundary at the mouth of the Petaluma River to its easternmost boundary at the shore on Mare Island. This mudflat supports an abundance of invertebrates and shellfish including ostracods, copepods, worms, snails, mussels, clams and crabs. On a low-outgoing tide, mudflat often more than 1 mile wide is exposed, providing foraging habitat for thousands of shorebirds.

Tidal sloughs also support a variety of wildlife. Detritus and plankton within the bay waters form the basis of the food chain in these tidal sloughs as well. Tidal sloughs provide an alternate habitat for feeding and resting as well as a corridor of exchange between the bay and adjacent marsh and upland habitats for many marsh dependent species.

Salt Marsh: Coastal salt marsh in the Refuge is subject to tidal inundation by salt water at least part of the year. It serves as a transition zone between the aquatic habitat of the bay and adjacent upland habitat. Most of the salt marsh in the Refuge is dominated by pickleweed, Pacific

cordgrass or salt grass which is determined by the frequency and duration of inundation with tidal waters. It is estimated that 85% of the historic salt marsh within the San Francisco and San Pablo Bays were filled, destroyed or reclaimed for agriculture or other development. Restoration efforts are for the conservation efforts of two salt marsh dependent endangered species: the California clapper rail and salt marsh harvest mouse.

3. Forests

The only vegetation over 20 feet tall on San Pablo Bay NWR is the Canary Island Palm trees (11) that surround Building 505 on Mare Island and a Eucalyptus tree south of the new temporary offices. These trees, like most of the vegetation on Mare Island, were planted over the years by the U.S. Navy--plant species collected from other parts of the world. The Palm trees give the refuge headquarters a tropical appearance and don't actually fit into the tidal marsh ecosystem but provide a unique landmark that will likely remain and offer nesting cover, perch sites and habitat for native birds, including raptors like barn owls.

9. Fire Department

Bryan Winton, Refuge Manager, serves as the San Francisco Bay NWR Complex liaison for fire management issues. However, Ivette Loredó and Joy Albertson remained instrumental in coordinating prescribed burning efforts for the 55-acre Antioch Dunes NWR. Roger Wong, San Luis NWR Fire Management Officer, serves as the Zone FMO for San Francisco Bay NWR Complex and coordinated fire management activities. No prescribed or accidental fires occurred on San Pablo Bay NWR in 2000.

10. Pest Control

Bryan Winton, Refuge Manager, serves as the San Francisco Bay NWR Complex liaison for mosquito and vector control issues. Joy Albertson, Wildlife Biologist, remained instrumental in overseeing and coordinating mosquito abatement activities on other satellite Refuges in the south Bay, and for the Complex. Solano County and Marin-Sonoma County Mosquito Abatement Districts continued to apply pesticides on San Pablo Bay NWR to reduce mosquito populations and potential health risks to humans. Bryan Winton presented on behalf of the Complex at the Annual Mosquito and Vector Control continuing education conference in San Ramon, California in February 2000.

Bryan Winton met with National Mosquito Coordinator, Mike Higgins in October 2000 to discuss policy issues for mosquito control efforts on National Wildlife Refuges. Mike will be preparing a national policy to provide direction for Refuges in coordinating efforts with mosquito abatement districts.

11. Water Rights

San Pablo Bay NWR does not own water rights on any of the existing lands currently under ownership or lease. Water management issues for former dredge ponds on Mare Island were discussed with Terry Iwagoshi, Weston, the company proposing to reactivate 7 dredge ponds on south Mare Island. We visited with Weston to identify if there could be options to receive decanted waters determined safe to discharge into the waters of the State by the Regional Water Quality Control Board. If so, the Refuge might work cooperatively to receive decanted saltwater periodically (especially during winter) to dilute rainfall and provide a brackish marsh habitat.

Berringer Winery consultants approached the Refuge to discuss possibilities of receiving processed water from a bottling plant on Mare Island currently in the planning stages. Berringer is exploring options of discharging water from the bottling plant into the Napa River (Carquinez Strait). Water suitable to discharge (freshwater) could be diverted to the Refuge to provide a cost-efficient source of freshwater to manage seasonal wetlands--possibly providing water management options otherwise not available or affordable.

G. WILDLIFE

1. Wildlife Diversity

San Pablo Bay NWR provides vital wetlands habitat critical for endangered species, resident and migratory waterfowl and shorebirds. San Pablo Bay NWR provides open water and habitat for a significant proportion of the Pacific Flyway population. Canvasback and Scaup and a wide array of migratory shorebirds benefit from food and resting areas within San Pablo Bay. Salt Ponds on California Department Fish & Game property north in the Napa-Sonoma Marshes Wildlife Area provide unique habitats for many bird and fish species. A wide host of birdlife, especially during winter months, makes the Refuge a national attraction.

2. Endangered and/or Threatened Species

The Refuge is home to the endangered Salt marsh harvest mouse, California clapper rail and California brown pelican. The salt marsh harvest mouse is salt marsh dependent, living in pickleweed dominated habitat with high vegetative cover. Some of the highest densities of mice have been live-trapped on the marshes on Mare Island and south of Highway 37. The California clapper rail is also tidal marsh dependent. It forages and travels within the numerous tidal channels found within marshes. The rails nest on elevated platforms constructed of *Spartina* and other marsh vegetation, often associated with *Grindelia* or other high spots in the marsh, in close proximity to channels. Numerous other threatened resident species to include several plants and fish utilize the Refuge during at least a portion of the year.

3. Waterfowl

The Refuge provides migration and wintering habitat for a significant proportion of the Pacific Flyway population of Canvasback and Scaup. These waterfowl species have a long history in the San Francisco Bay. "Cans" and "bluebills" have been a favorite target of local hunters during the winter migration. Several floating blinds still are anchored annually to provide hunting platforms for these waterfowl species.

4. Marsh and Water Birds

Marin Islands NWR includes the largest egret and heron rookery in San Francisco Bay and these birds conduct dailing migrations to and from San Pablo Bay NWR to feed (species in the colony include: Great blue herons, Great Egrets, Snowy Egrets and Black-crowned night herons). Efforts were initiated in November 2000 to evaluate viability of establishing another unit of the Refuge System, Marin Baylands NWR to further protect endangered, threatened and migratory species.

5. Shorebirds, Gulls, Terns, and Allied Species

Migratory shorebirds are very abundant in northern San Francisco Bay in the area known as San Pablo Bay. The salt ponds managed by the California Department of Fish & Game are critical resting and feeding sites for shorebirds during high tides. Current research is underway to evaluate the vital importance of these unique habitats in the San Francisco Bay Estuary to migratory shorebirds.

Several gull and tern species are abundant to numerous in and around the Refuge during the winter months. California least terns, Forster's terns, Caspian terns and Bonapart's gulls have been observed during spring and summer feeding in Tolay Creek and on California Department of Fish & Game Napa-Sonoma Marshes Wildlife Areas in the north bay.

6. Raptors

Red-tailed hawks are very abundant during winter and Northern harriers (Marsh Hawks) are seen year-around. White-tailed kites, Sharp-shinned hawks, and American kestrels are often sighted. Red-shouldered hawks are less abundant but often observed on the same pole or often in the same general location when sighted. Turkey vultures can be found periodically throughout the year.

Great-horned owls nested at Cullinan Ranch (inside the big barn) in 2000 and moved to the metal pole barn for 2001. Barn owls are commonly sighted on Mare Island. Barn owls use the Canary Island date palm trees fronting Bldg 505 for roosting and nesting.

Federal Agents for the FWS in coordination with Louise Vicencio, Wildlife Biologist discovered over 100 dead raptors, mainly red-tailed hawks in the vicinity of Skaggs Island in 2000. The salvaged birds were submitted to several locations for analysis and no significant poisoning, viruses, or other definitive causes of death were pinpointed except for emaciation and bacteria (possible infection).

7. Other Migratory Birds

San Pablo Bay NWR is important to a host of other migratory birds. Meadowlarks, Robins, Red-shafted Flickers, Ruby-crowned kinglets, Phoebe's, Yellow-crowned sparrows, White-crowned sparrows, and Killdeer, and many other birds use the Refuge during Spring and Fall migrations.

8. Game Mammals

The only big game animal found today on San Pablo Bay NWR is the black-tailed deer. As many as 5 in a group have been observed during a single visit of the Lower Tubbs Island managed marsh on the Refuge. Tolay Creek is the only unit of the Refuge with deer present. No sightings have been made of deer on Mare Island or Cullinan Ranch. No big game hunting is allowed on the Refuge.

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

9. Marine Mammals

Harbor seals have been observed on San Pablo Bay NWR. A historic haul-out site at Lower Tubbs Island is one of the only locations seals have used in northern San Pablo Bay.

10. Other Resident Wildlife

Pheasants are found at the Tolay Creek, Lower Tubbs Island Units and on Mare Island. Adults with chicks were observed on Mare Island this year in July. Pheasants are stocked/released from the Black Point Gun Club west of Sears Point--less than 1 mile from the western edge of the Refuge. Pheasants are an introduced species of upland game bird.

Pheasant hunting is allowed on the Tolay Creek Unit of the Refuge. However, since the December 1998 tidal restoration, habitat needed for pheasant cover has been limited to areas immediately adjacent to the access levee road and primarily in habitat located on the Vallejo Sanitation and Flood Control District (VSD) and tenant farmer Norm Yenni's farmfield. Meeting with VSD indicate a conflict of interest with public accessing agriculture lands. Therefore, the

Refuge is currently reassessing whether pheasant hunting will be promoted in future years.

11. Fisheries Resources

Delta smelt have been found in some abundance in Lower Tubbs Island managed marsh. Stripers, sturgeon, and salmonids are locally abundant. Other fisheries research studies are currently under investigation in the California Department of Fish & Game salt ponds. The San Francisco Bay Estuary Field Station staff are currently cooperating with Department of Fish & Game staff to conduct fish sampling on the Refuge, pending Collecting Permits from Sacramento Ecological Services office.

15. Animal Control

Red fox were observed hit along Highway 37 (west of Tolay Creek bridge) and alive on Mare Island in 2000. Animal control to reduce impacts to endangered species and to improve nesting success of resident waterfowl during spring and summer may be initiated pending outcome of a Predator Management Plan currently in draft form. Bryan and Louise Vicencio, Wildlife Biologist may engage in predator control during spring if such an activity is deemed appropriate to improve nesting success of waterfowl and further protect vulnerable California clapper rails and/or Salt marsh harvest mice. Animal control is currently being conducted by APHIS staff as required by the Navy's biological opinion for the transfer of Mare island to the city of Vallejo. One half-time staff person is assigned to the position. Bryan Winton, Refuge Manager, has extensive experience in furbearer trapping which may prove beneficial in this effort.

16. Marking and Banding

San Francisco Bay Estuary Field Station staff continued to monitor Canvasback and Scaup movement with aid of radio transmitters (telemetry equipment). The goal of this study is to provide valuable insight into feeding locations of these waterfowl species and to correlate feeding areas with heavy metal concentrations found in salvaged birds. Telemetry studies are the focus of the co-located USGS field-personnel headquartered with the Refuge. Long-billed dowitchers from adjacent California Department of Fish & Game Lands were captured and banded in 2000 by USGS.

H. PUBLIC USE

1. General

The public use areas on San Pablo Bay NWR are located in open water of northern San Pablo Bay for hunting and fishing. The Tolay Creek and Lower Tubbs Island units are open to hunting of pheasants and for wildlife observation, environmental education and nature photography. Other areas of the Refuge (Cullinan Ranch and Mare Island) are closed to the public year-round except for one weekend (3rd week in January) during the annual Northern San Francisco Bay Flyway Festival.

The Refuge staff submitted a draft general station brochure to EPIC in R1 (Ruppert Vaughn) for printing of a new Station color brochure for San Pablo Bay NWR. Several meetings were held to coordinate and distribute workload. Louise Vicencio ensured brochure draft was completed and submitted. Fran McTamaney, Cara Rancourt, Tony Batiste (photos), Myrna Hayes and Matt Gay assisted with ideas for the draft.

2. Outdoor Classrooms - Students

Fran McTamaney, Environmental Education (EE) Coordinator for the Refuge Complex and a Student Conservation Association (SCA) Intern designs and conducts the EE field trip program at San Pablo Bay NWR. From mid-September to mid-June, Fran trains and supervises 3 different, 3-month interns to provide educator-led field trip for Grades K-6 on Mare Island. Fran works one or two day a week at San Pablo Bay NWR and the other days supervising the EE programs at the EEC in Alviso and the Visitor Center in Fremont--at the Complex headquarters. The students learn about the marsh habitat, migratory birds and threatened and endangered species. During 2000, educators brought 638 students on field trips (this includes one girl scout group).

3. Outdoor Classrooms - Teachers

During 2000, 45 educators were trained by Fran McTamaney, EE Coordinator for the Refuge Complex and an SCA intern at 5 four-hour Field Trip Orientations conducted in fall, winter and spring. Thirty-eight educators brought their students on field trips. One hundred and two parents helped the educators conduct the field trips. Fran and the SCA intern advertise the EE Program at Local EE Fairs and at the quarterly meetings 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. Many more educators are trained than come back on field trips, this is due to lack of parental help, cost of buses and the push for academics in Grades K-3. In 2001, the need for an in-class wetlands program will be pursued.

4. Interpretive Foot Trails

Bryan Winton and Louise Vicencio, San Pablo Bay NWR staff and Fran McTamaney, Environmental Education Coordinator for the Complex will collaborate to organize and draft and

indepth sign/trail plan for the northern units of Mare Island currently or anticipated to be managed by the Refuge. Three inactive dredge ponds have elevated levees surrounding them which will be future public access trails. Compatibility determinations and an Environmental Assessment will be prepared to evaluate the balance of public use opportunities and management for endangered, resident and migratory species. Signs for foot trails are currently being discussed.

5. Interpretive Tour Routes

No automobile or bicycling tour routes are available to the public on San Pablo Bay NWR. However, State Highway 37 crosses a 9-mile portion of the Refuge and Napa-Sonoma Marshes Wildlife Area--some of the most productive wetlands remaining in the San Francisco Bay area. The Lower Tubbs Island unit is an 8.8 mile (round-trip) public use area on the Refuge but crosses properties owned by the Vallejo Sanitation and Flood Control District. The District is not supportive of hunting and access (both liability issues) and access along the levee road is impassable during wet weather. Therefore, no auto tour has been proposed for Lower Tubbs Island Unit, although there remains much potential for interpretive signage depicting wetlands restoration and wildlife availability.

6. Interpretive Exhibits/Demonstrations

Building 505, the home of the future Wildlife/Environmental Discovery Center, San Pablo Bay NWR headquarters, and co-located federal and possibly state environmental organizations will be the site of interpretive exhibits/demonstration when the renovation of the building is completed in 2004. Until then, the Refuge does not have an official public interpretive center but relies on the Complex headquarters to serve this component of the outreach and education for the Refuge. Refuge staff participated in off-site local community events - Earth Days at American Canyon and Concord in Solano and Contra Costa County, respectively.

7. Other Interpretive Programs

Outreach opportunities include EE fairs for Earth Day and Coastal Cleanup Efforts. The Flyway Festival has been the main outreach vehicle for San Pablo Bay NWR. Besides the dedicated work of the Refuge staff and volunteers, the headquarters provided assistance via the Volunteer Coordinator, James Aliberti, and between 15-20 volunteers and Complex staff. The event would be impossible to conduct without the valiant effort of the Complex staff. Display tables for the Complex and San Pablo Bay NWR are present, wetland walks are supervised and conducted, children's craft room and carpenter area for birdhouse construction were available. Future events will likely include weekend celebrations to provide visitor access to Mare Island for Migratory Bird Day and National Wildlife Refuge Week, spearheaded by Louise Vicencio, Wildlife Biologist.

8. Hunting

San Pablo Bay NWR is open 7 days a week for hunting of waterfowl under State of California hunting regulations for bag limits and seasons. San Pablo Bay NWR offers some of the best hunting in the country for "cans" and "bluebills" (i.e. Canvasback and Scaup). The Refuge also offers pheasant hunting due to an abundant population of escaped birds from Black Point Gun Club on Fred Dickson's property.

The 50 CFR for hunting regulations was amended in early 2001 to provide consistent guidance for number of shells and type (steel shot) for pheasant hunting, and to improve communication capabilities with floating duck blind owners. Vallejo Sanitation District provides levee access for the Refuge, State Fish & Game Department and the public to the Lower Tubbs Island/Levee Setback units of the Refuge. VSD has identified opposition to future pheasant hunting since most of the remaining habitat is on their property now. The Refuge will evaluate closing the pheasant hunting season in 2001. Deed restrictions stated the Refuge could not allow hunting in the 249-acre muted/managed tidal marsh of Lower Tubbs Island.

9. Fishing

San Pablo Bay NWR is open 7 days a week for fishing for local bay fish. Sturgeon and stripers are the most sought-after bay fishes. Both can grow to be good size. Commercial fishing permit holder under State authority, Darin Sanders had 45 minnow-style traps confiscated as part of an illegal fishing activity on the Refuge. Louise Vicencio, Wildlife Biologist discovered and removed the unlabeled, unpermitted traps. After legal investigation, the traps were returned to the rightful owner under condition that no future fish trapping would be permitted on the Refuge.

10. Trapping

No trapping is allowed except for research purposes on the San Pablo Bay NWR. A predator management plan is currently in draft form which will dictate whether San Pablo Bay NWR considers furbearer trapping to enhance waterfowl nesting and increase protection for endangered species.

11. Wildlife Observation

San Pablo Bay NWR offers several locations to observe wildlife. The Cullinan Ranch unit is observable from a California Department of Fish & Game parking lot on the north side of Highway 37, 3 miles west of Mare Island. The Tolay Creek parking area jointly managed by California Department of Fish & Game and the Refuge offers excellent wildlife viewing, and is the gateway to the 8.8 mile, 435-acre tidal restoration project. Waterfowl, gulls, shorebirds, herons, and raptors are generally present and kites, pheasants, song-sparrows, and red-winged

blackbirds are frequently observed. Tolay Creek is a must see for any north bay adventurer. No pets, horses, or wheeled conveyances are allowed although retrievers are permitted during the hunting season.

12. Other Wildlife Oriented Recreation

The Northern San Francisco Bay Flyway Festival offers a 3-day event during the 3rd week of January annually where the public can experience first-hand the abundant wildlife in the tidal marshes of the San Pablo Bay NWR and surrounding tidelands. The roof-top viewing of Building 505 offers an excellent opportunity to view the expansive marsh, mudflats, and open water of northern San Pablo Bay. In year 2000, nearly 3000 people attended the Saturday event. One hundred and forty people attended the wetland walks on the trails on north Mare Island. Access to the habitat on Mare Island was limited due to availability of tour guides. A wine and cheese reception and art show kicked off the festival on the Friday evening prior when Peter Baye, Botanist with Ecological Services branch of the U.S. Fish & Wildlife Service presented a slide show on rare plants of the San Francisco Bay Estuary. The last day of the festival including guided tours by Refuge staff and Napa-Solano Audubon Society president, Jerry Karr, of Cullinan Ranch and Tolay Creek units of the Refuge, although heavy rains resulted in low public turnout.

15. Off-road Vehicles

No off-road vehicles are allowed on San Pablo Bay NWR except for county staff engaged in mosquito management activities. Argos vehicles are the off-road vehicle most used for surveillance and monitoring mosquitos on the Refuge. Their use is controversial regarding overall impact on endangered species (salt marsh harvest mice) and survival of pickleweed habitat. Some hunters use bicycles to transport decoys and equipment for duck hunting at the Tolay Creek area. These uses will be evaluated for appropriateness and compatibility in the upcoming months.

17. Law Enforcement

U.S. Fish & Wildlife Service Special Agents held a law enforcement training at the Mesa Road headquarters in early 2000.

Special Agent, Bob Snow lead the investigation of a raptor die-off identified at Skaggs Island and surrounding baylands (farmlands; included over 100 immature red-tailed hawks), and Refuge Officer, Barry Tarbet investigated a commerical minnow trapper, Darin Sanders, operating under California Department of Fish & Game permit, but illegally trapping on the Refuge. Confiscated traps (~40) were eventually returned.

Law Enforcement and patrols are conducted and managed by Clyde Morris, San Francisco Bay NWR Complex and Refuge Officers Jon Adams and Barry Tarbet. The Refuge generally gets 2 days a months coverage by Refuge and Federal Agents working for the U.S. Fish & Wildlife Service. California Department of Fish & Game Game Wardens patrol and enforce wildlife laws on the Refuge, and Louise Vicencio, Wildlife Biologist, organized and hosted a joint agency law enforcement meeting to improve coordination and cooperation between State and Federal Officers, and to address signage and enforcement issues, and clarify regulations.

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

The co-located headquarters for San Pablo Bay NWR, San Francisco Bay Estuary Field Station (USGS), Ecological Services, and Migratory Bird Management biologist/pilot relocated from Mesa Road to Building 505 at Cedar & "I" Street on 9 August 2000. This move followed a contract relocation of 2 mobiles made available by the Department of the Navy: a 36' x 60' 11-office unit, and a 20' x 50' former deli to be remodeled as a conference room/bathrooms. By December 2000, the offices had been relocated, utilities connected, remodeled, roof repairs, stairway construction, painting, kitchen, bathroom, and back deck construction. Jim Griffin, Maintenance worker led the effort but Arthur Chan and Juan Flores, also Maintenance workers from the Complex assisted with additional relocation tasks for the Refuge. Thanks to Jim Millholland, new refuge volunteer for 20-30 weeks of time on-average, and all Refuge and Complex staff for helping make the transition smooth.

3. Major Maintenance

The only Major maintenance for the year included a large tractor tire replacement/repair for the John Deere 6800 tractor and the replacement of the sump pump below Building 505 for removing basement water during winter. Thanks to Juan Flores for the sump pump replacement. Other major maintenance included everything it took to get the computers and phones operational during the transition. Thanks to John Takekawa, Unit Leader of the U.S. Geological Survey, San Francisco Bay Estuary Field Station for his time and attention to these technological logistics and repairs.

4. Equipment Utilization and Replacement

Fire funds allowed for acquisition of an additional ATV for use of exotic plant control and FIRE management activities in 2000. In addition, the Refuge purchased a slide hammer, air compressor, ATV trailer, and several other supplies for management and safety needs.

5. Communications Systems

The Refuge continues to function effectively with outdated communications equipment (particularly cell phones). Computer equipment for Refuge employees will be upgraded in 2001.

6. Energy Conservation

The Refuge headquarters relocated in August 2000 and power sources changed from electricity/propane to solely electricity. Alternative heating/cooling sources will be pursued. The Refuge engaged in a recycling effort by sorting cardboard, paper, plastic, bottles, and trash. This effort was spearheaded by Peter Baye, Botanist for Ecological Services.

J. OTHER ITEMS

1. Cooperative Programs

Duck's Unlimited, Inc. has historically provided engineering and financial management assistance to the Refuge. Fees and processes for Ducks Unlimited changed in 2000 which reduced the value of their contribution to the Refuge. Future cooperative management with DU will be re-evaluated upon completion of the Levee Setback and Cullinan Ranch tidal restoration projects.

A Friends Group Mentor Program was contacted to assist Refuge Manager, Bryan Winton and activist Myrna Hayes reach agreement regarding Refuge management issues. Molly Krival, 1999 NWRS Volunteer of the Year recipient, led the effort. Bryan attended NCTC training on "Working with and developing Friends groups" but no "group" has yet to be identified.

3. Credits

This narrative report was written by Bryan Winton.

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Albertson, Ivette Loredó, Joelle Buffa, Clyde Morris, Matt Gay, Fran McTamaney, Sandy Spakoff, Genie Moore, Carmen Leong, Point Reyes Bird Observatory, University of California, Audubon Canyon Ranch, Ron Howard, George Young, John Cerini, Gill Hollingsworth, Tom Sheaff, Fred Dickson, Jack Bauer, Bill Bodeau, Brian Jordan, Phil Sheridan, Norm Yenni, Paul Sheffer, Vic Baracosa, Chuck Krauss, Harvey Goldberg, and NBAA for making the Refuge a productive and exciting year. Thanks to everyone unnamed who helped with refuge with cleanup projects in 2000--California Conservation Corps and Coastal Cleanup crews, and Ron Mathis for barn and fence removal efforts. Thanks especially to Ducks Unlimited for helping the Refuge make progress on projects and for the wardens with California Department of Fish & Game that keep us continually informed of hunting/fishing activities on Refuge lands. Thanks to the families of Bryan Winton and Louise Vicencio for tolerating the long hours and unmatched commitment to protecting natural resources.

K. APPENDICES

1. Climatic Conditions for 2000
2. Land Acquisition History
3. San Pablo Bay Area Maps
4. Photographic Documentation (Selected Photos/Projects)

CLIMATIC CONDITIONS for 2000

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY (2000)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: 049219/99999, VALLEJO MARINE WORLD, California

Elev. 130 ft. above sea level

Lat. 38°08'N, Lon. 122°14'W

| Date | Temperature (° F) | | | | | | | | | | | | | | Precipitation (inches) | | | | | | | | | | | |
|---------------|-------------------|--------------|-------|---------------------------|---------------------------|---------------------------|---------|--------------|--------|-------------|----------------|--------------|--------------|-------------|------------------------|---------------------------|-------------------|------|---------------|--------------|-------------|----------------|-------|-------|--|--|
| Elem-> | MMXT | MMNT | MNTM | DPNT | HTDD | CLDD | EMXT | | EMNP | | DT90 | DX32 | DT32 | DT00 | TPCP | DPNP | EMXP | | TSNW | MXSD | | DP01 | DP05 | DP10 | | |
| 2000 Month | Mean Max. | Mean Min. | Mean | Depart. from Normal | Heating Degree Days | Cooling Degree Days | Highest | High Date | Lowest | Low Date | Number of Days | | | | Total | Depart. from Normal | Greatest Observed | | Snow, Sleet | | | Number of Days | | | | |
| | | | | | | | | | | | Max >=90° | Max <=32° | Min <=32° | Min <=0° | | | Day | Date | Total Fall | Max Depth | Max Date | >=.10 | >=.50 | >=1.0 | | |
| 1 | 58.3 | 42.9X | 50.6X | | 439B | 0B | 64 | 5 | 30 | 2 | 0 | 0 | 1 | 0 | 7.03 | | 2.10 | 24 | 0.0 | 0 | | 13 | 3 | 1 | | |
| 2 | 59.9 | 46.1X | 53.0X | | 344B | 0B | 67 | 7 | 34 | 24 | 0 | 0 | 0 | 0 | 9.73 | | 1.47 | 13 | 0.0 | 0 | | 14 | 9 | 3 | | |
| 3 | 67.6 | 45.0X | 56.3X | | 286B | 12B | 85 | 31 | 39 | 24 | 0 | 0 | 0 | 0 | 3.19 | | 0.97 | 5 | 0.0 | 0 | | 6 | 3 | 0 | | |
| 4 | 71.2 | M | M | | M | M | 83 | 26 | 42 | 18 | 0 | 0 | 0 | 0 | 0.94 | | 0.94 | 17 | 0.0 | 0 | | 1 | 1 | 0 | | |
| 5 | 76.5 | 51.0X | 63.8X | | 88B | 58B | 98 | 22 | 39 | 12 | 3 | 0 | 0 | 0 | 0.82 | | M | | 0.0 | 0 | | 0 | 0 | 0 | | |
| 6 | 82.3 | 54.4X | 68.4X | | 26B | 146B | 110 | 15 | 48 | 1 | 3 | 0 | 0 | 0 | 0.25 | | 0.25 | 8 | 0.0 | 0 | | 1 | 0 | 0 | | |
| 7 | M | M | M | | M | M | 93 | 31 | 52 | 7 | 1 | 0 | 0 | 0 | 0.00 | | 0.00 | 31 | 0.0 | 0 | | 0 | 0 | 0 | | |
| 8 | 82.8 | 55.9X | 69.4X | | 7B | 145B | 94 | 16 | 53 | 25 | 6 | 0 | 0 | 0 | 0.04 | | 0.04 | 30 | 0.0 | 0 | | 0 | 0 | 0 | | |
| 9 | M | M | M | | M | M | 99 | 18 | 49 | 5 | 5 | 0 | 0 | 0 | 0.10 | | 0.10 | 22 | 0.0 | 0 | | 1 | 0 | 0 | | |
| 10 | 72.5X | 50.9X | 61.7X | | 104B | 11B | 91 | 2 | 41 | 31 | 1 | 0 | 0 | 0 | 2.25 | | M | | 0.0 | 0 | | 3 | 1 | 0 | | |
| 11 | M | M | M | | M | M | 76 | 7 | 31 | 14 | 0 | 0 | 2 | 0 | 2.13 | | 0.70 | 29 | 0.0 | 0 | | 3 | 2 | 0 | | |
| 12 | M | M | M | | M | M | 66 | 18 | 35 | 2 | 0 | 0 | 0 | 0 | 0.95 | | 0.45 | 14 | 0.0 | 0 | | 3 | 0 | 0 | | |
| Annual | M | M | M | | M | M | 110 | Jun | 30 | Jan | 19 | 0 | 3 | 0 | 27.43 | | M | Jan | 0.0 | 0 | | 45 | 19 | 4 | | |

Notes

(blank) Not reported.

+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence. Used through December 1983 only.

A Accumulated amount. This value is a total that may include data from a previous month or months or year (for annual value).

B Adjusted Total. Monthly value totals based on proportional available data across the entire month.

E An estimated monthly or annual total.

X Monthly means or totals based on incomplete time series. 1 to 9 days are missing. Annual means or totals include one or more months which had 1 to 9 days that were missing.

M Used to indicate data element missing.

T Trace of precipitation, snowfall, or snowdepth. The precipitation data value will = zero.

Elem- Element Types are included to provide cross-reference for users of > the NCDC CDO System.

Station Station is identified by: CoopID/WBAN, Station Name, State.

S Precipitation amount is continuing to be accumulated. Total will be included in a subsequent monthly or yearly value. Example: Days 1-20 had 1.35 inches of precipitation, then a period of accumulation began. The element TPCP would then be 00135S and the total accumulated amount value appears in a subsequent monthly value. If TPCP = "M" there was no precipitation measured during the month. Flag is set to "S" and the total accumulated amount appears in a subsequent monthly value.

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY (2000)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **046066/93227, NAPA COUNTY AP, California**

Elev. 14 ft. above sea level

Lat. 38°13'N, Lon. 122°17'W

| Date | Temperature (° F) | | | | | | | | | | | | | | Precipitation (inches) | | | | | | | | | | | |
|---------------|-------------------|--------------|------|---------------------------|---------------------------|---------------------------|---------|--------------|--------|-------------|----------------|-------------|-------------|------------|------------------------|---------------------------|-------------------|------|---------------|--------------|-------------|----------------|------|------|--|--|
| Elem-> | MMXT | MMNT | MNTM | DPNT | HTDD | CLDD | EMXT | | EMNP | | DT90 | DX32 | DT32 | DT00 | TPCP | DPNP | EMXP | | TSNW | MXSD | | DP01 | DP05 | DP10 | | |
| 2000 Month | Mean Max. | Mean Min. | Mean | Depart. from Normal | Heating Degree Days | Cooling Degree Days | Highest | High Date | Lowest | Low Date | Number of Days | | | | Total | Depart. from Normal | Greatest Observed | | Snow, Sleet | | | Number of Days | | | | |
| | | | | | | | | | | | Max ≥90° | Max ≤32° | Min ≤32° | Min ≤0° | | | Day | Date | Total Fall | Max Depth | Max Date | ≥.10 | ≥.50 | ≥1.0 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 2 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 3 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 4 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 5 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 6 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 7 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 8 | M | M | M | | M | M | M | | M | | M | M | M | M | M | | M | | | M | | M | M | M | | |
| 9 | 80.1 | 52.0 | 66.1 | | 40 | 80 | 97 | 18 | 43 | 4 | 6 | 0 | 0 | 0 | 0.10 | | 0.09 | 22 | | 0 | | 0 | 0 | 0 | | |
| 10 | 69.8 | 46.3 | 58.1 | | 210 | 3 | 80 | 23 | 34 | 31 | 0 | 0 | 0 | 0 | 1.61 | | 0.51 | 26 | | 0 | | 5 | 1 | 0 | | |
| 11 | 59.3 | 35.2 | 47.3 | | 526 | 0 | 77 | 3 | 22 | 12 | 0 | 0 | 8 | 0 | 1.05 | | 0.57 | 29 | | 0 | | 3 | 1 | 0 | | |
| 12 | 57.2 | 35.8 | 46.5 | | 566 | 0 | 66 | 17 | 27 | 29 | 0 | 0 | 10 | 0 | 0.78 | | 0.38 | 11 | | M | | 2 | 0 | 0 | | |
| Annual | M | M | M | | M | M | M | Sep | M | Nov | M | M | M | M | M | | M | Nov | | M | | M | M | M | | |

Notes

(blank) Not reported.

+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence. Used through December 1983 only.

A Accumulated amount. This value is a total that may include data from a previous month or months or year (for annual value).

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LAND ACQUISITION

Tract number, name, cost

SAN PABLO BAY NATIONAL WILDLIFE REFUGE

Page 1

| Tract No. | Acquired Date | County | Tract Name | Fund Auth | Int Acq | Final Acres | Final Cost |
|--------------|------------------|--------|---------------------|--------------|------------|----------------|------------|
| 12 | 2/06/74 | SOLANO | J. M. FIGUERAS ET A | MBCF | FEE | 185.00 | 167,500. |
| 14 | 10/02/78 | SONOMA | THE NATURE CONSERVA | NONE | FEE | 248.72 | 0. |
| 2 | 9/25/80 | SOLANO | STATE OF CALIFORNIA | OTHE | LEA | 11,200.00 | 0. |
| 13 | 8/01/86 | SOLANO | PRATI ET AL EDWARD | MBCF | FEE | 63.00 | 75,900. |
| 18a | 1/17/91 | NAPA | CULLINAN RANCH | LWCF | FEE | 28.00 | 122,200. |
| 18 | 6/28/91 | SOLANO | CULLINAN RANCH | LWCF | FEE | 1,465.00 | 6,377,000. |
| Totals: | | | | | | 13,189.72 | 6,742,600. |

SAN PABLO BAY NATIONAL WILDLIFE REFUGE : PROPOSED LAND ACQUISITION

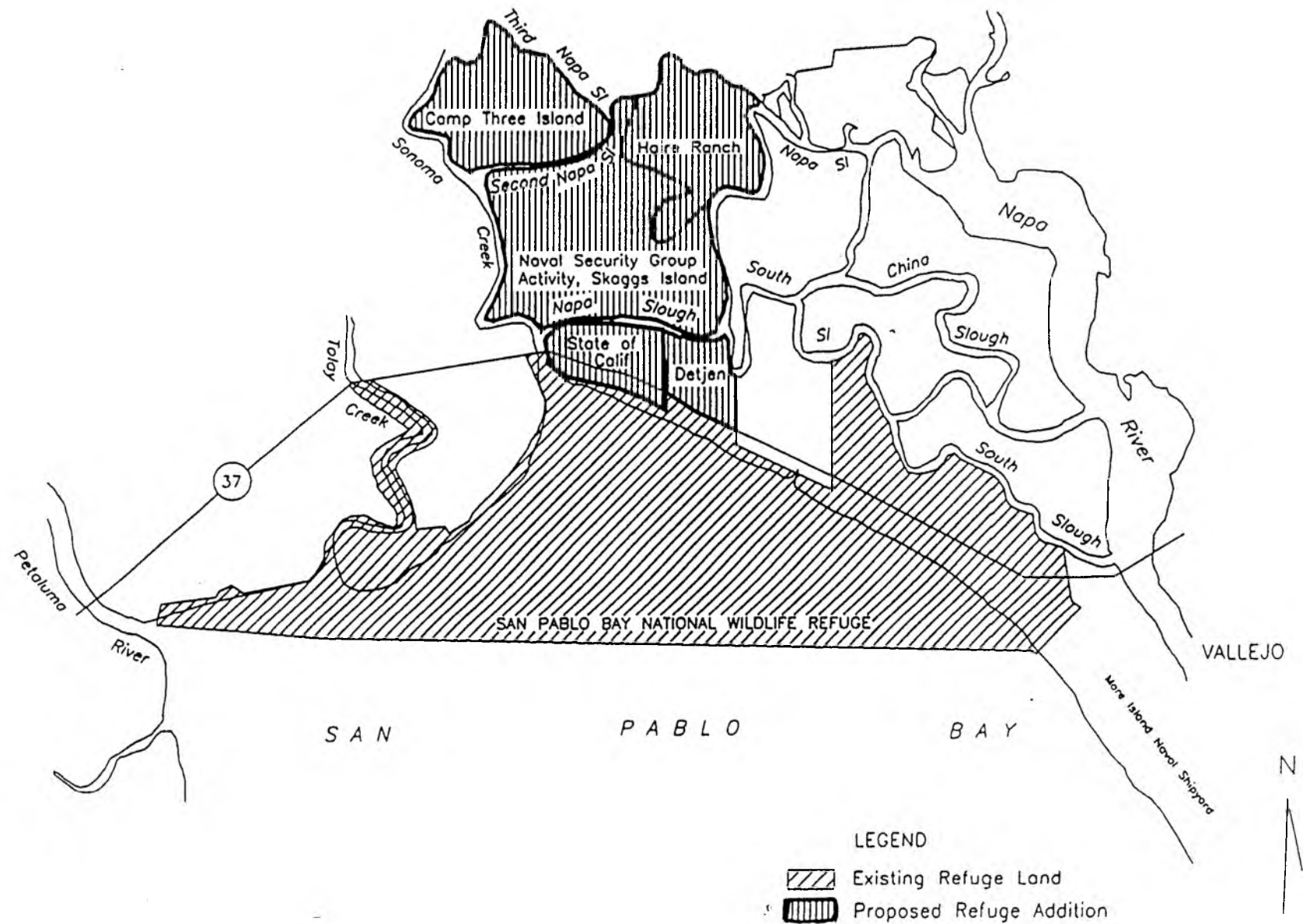


Table 1. Ownership, Acreage, and Acquisition Priorities of Proposed Additions to San Pablo Bay National Wildlife Refuge

| Tracts | Hectares | Acres | Priority | Interest | Current Owner* |
|------------------------|--------------|--------------|----------|--------------------------|-------------------------|
| Skaggs Island (1) | 1,341 | 3,310 | 1 | Fee title (via transfer) | Dept. of Defense (Navy) |
| Detjen Duck Club (19) | 203 | 500 | 2 | Fee/ease-ment | Detjen Club |
| Camp Three Island (20) | 587 | 1,450 | 3 | Fee/ease-ment | Kiser |
| Haire Ranch (21) | 441 | 1,090 | 4 | Fee/ease-ment | Haire Ranch |
| West End Club (2) | 313 | 774 | 5 | Lease | State of California |
| Total | 2,885 | 7,124 | | | |

*Source: California State 1993.

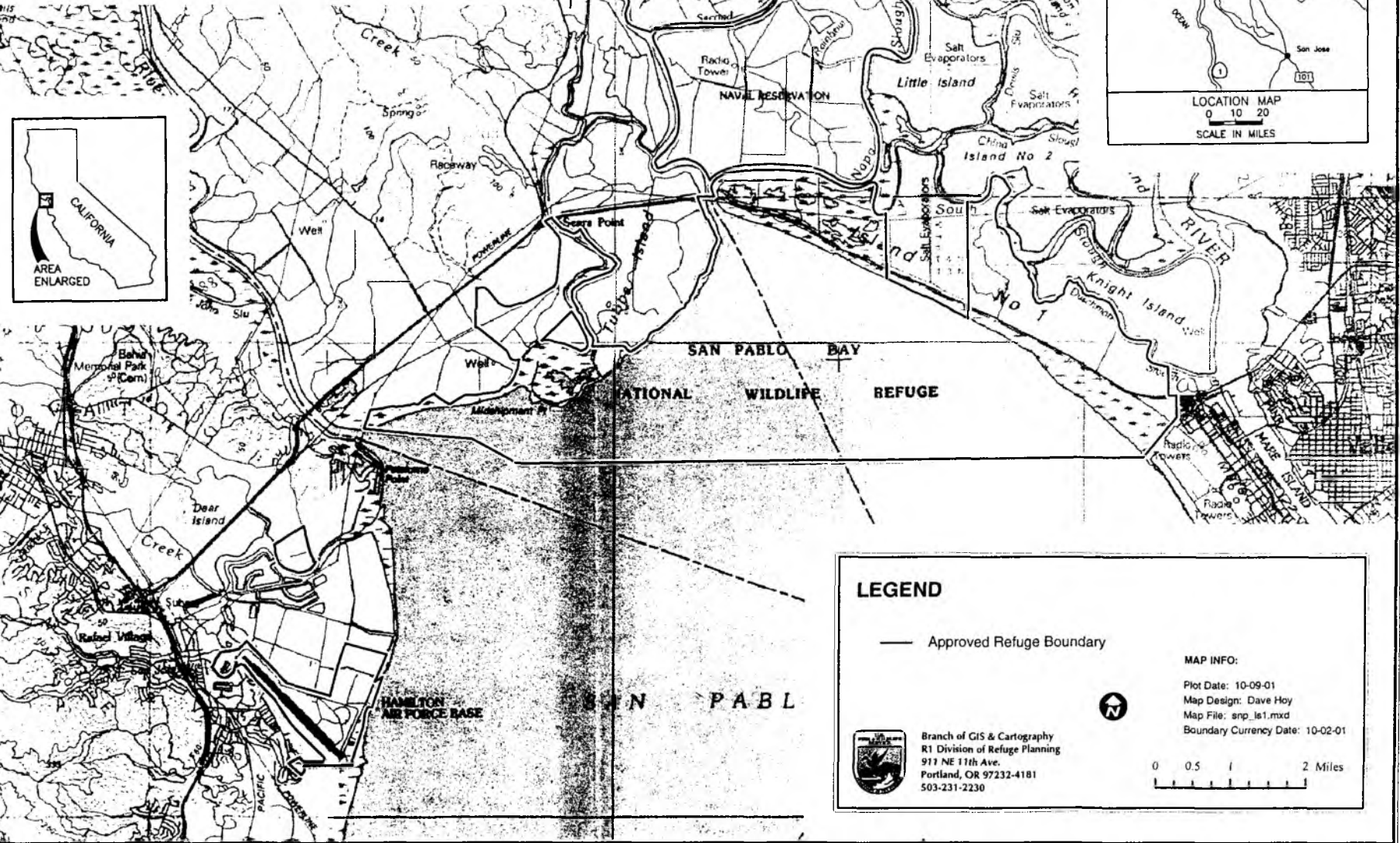
REFUGE MAPS

U.S. Fish & Wildlife Service

San Pablo Bay

National Wildlife Refuge

APPROVED REFUGE BOUNDARY



LEGEND

— Approved Refuge Boundary

MAP INFO:

Plot Date: 10-09-01

Map Design: Dave Hoy

Map File: snp_1e1.mxd

Boundary Currency Date: 10-02-01



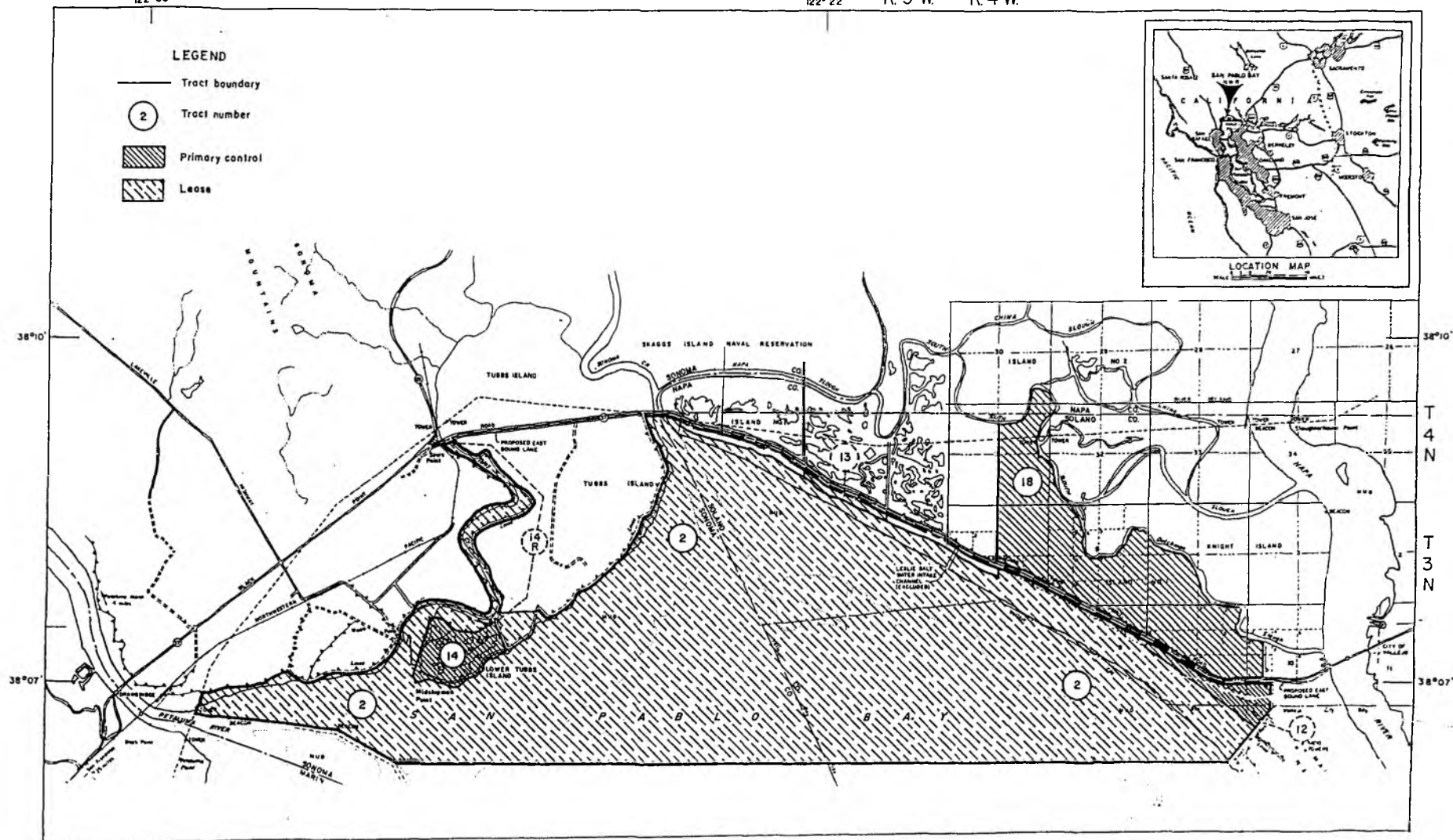
Branch of GIS & Cartography
R1 Division of Refuge Planning
911 NE 11th Ave.
Portland, OR 97232-4181
503-231-2230



0 0.5 1 2 Miles

UNITED STATES
DEPARTMENT OF THE INTERIOR
122°30'

122° 22' R. 5 W. R. 4 W.



PHOTOGRAPHS
of Accomplishments



California Poppies offer a beautiful foredrop to the famed Building 505, former Naval Pacific Group Communications Center, on Mare Island--anticipated to be renovated over the next three years to establish a permanent headquarters for the San Pablo Bay National Wildlife Refuge and public accessible "Wildlife Discovery Center" (photographs taken by Bryan Winton, Refuge Manager)





(Above) Tyler Winton poses fronting the Mesa Road headquarters for the San Pablo Bay National Wildlife Refuge on southern Mare Island

(Below) Chris Barr, Maintenance Supervisor, and Joelle Buffa, Farallon NWR and Supervisory Wildlife Biologist work alongside Refuge volunteers to rehabilitate the new temporary headquarters for the San Pablo Bay National Wildlife Refuge





A before and after shot of the location of the new temporary headquarters for the San Pablo Bay National Wildlife Refuge





Preparation for the Cullinan Ranch tidal wetland restoration project included pumphouse and Eucalyptus tree removal in 2000, projects administered by Ducks Unlimited Inc.





Two items removed in 2000;

The wooden structures on Cullinan Ranch, recycled by Rich Mathis of Oregon (above)

Illegal fishing traps (45) from Tolay Creek owned by Darin Sanders of Lodi, California (eventually returned) (below)





Years of accumulated debris created a wrack-line of lumber atop the levee separating the Figueras unit from tidelands leased from the State. In effort to re-establish a future public use trail and reduce cover for bird and mouse predators, California Conservation Corps crews retrieved and piled debris to expedite disposal.





Jim Millholland, new Refuge Volunteer in 2000, assists with mowing on the grounds behind Building 505





Jim Millholland, Refuge Volunteer and tractor operator, assists with Cattail reduction on the southern edge of the future Mare Island component of San Pablo Bay National Wildlife Refuge (above)

The high-security north Mare Island fence was removed by Rich Mathis of Oregon in December 2000. The fence, chainlink, and telephone lines were all that separated the breath-taking views from Mare Island to Sears Point.





Fred Dickson of Dickson Brothers Ranch, property located west of the Tolay Creek tidal restoration project, received levee repairs and recoring as a result of reintroduced tidal action (above). Oat-hay production in Field 15 of Mr. Dicksons farm was negatively impacted by saltwater intrusion (below)





California Department of Fish & Game and Ducks Unlimited Inc. partner to install erosion-reducing fabric atop fresh fill provided by U.S. Fish & Wildlife Service (above)

Knee-deep in Phase I construction, the Lower Tubbs Island 72-acre tidal restoration project was initiated in November, 2000 (below)





Louise Vicencio, Wildlife Biologist serves as reference to the extensive erosion experienced on the upper stretch of the Vallejo Sanitation and Flood Control District levee as part of the Tolay Creek Restoration project initiated in December 1998 (above)

Extensive erosion and "scarp formation" along the northeast corner of the California Department of Fish & Game mitigation impoundment (below)





Chuck Morton, Caltrans Biologist and Louise Vicencio, Wildlife Biologist for San Pablo Bay NWR observe rebar stakes once holding several square bales of hay-- efforts to reduce erosion along the northern edge of the Tolay Creek tidal restoration project (HW 37)

Bryan Winton, Refuge Manager, (headless) serves as reference to the areas of most extensive erosion along HW 37. The Tolay Creek tidal restoration project eroding into the roadbed of HW 37





California Conservation Corps (CCC) crewmembers consisted of young adults with most ethnic backgrounds represented. Stationed on Mare Island, the crewmembers enjoyed have work close to home and learning about the environment in their back yard (above)

Jim Millholland, Refuge Volunteer, supervised the CCC progress and insured debris piles and vegetation maintenance did not jeopardize future wildlife management objectives. Wompas, yellow labrador retriever, assisted with searches for Xiana Fairchild, missing Vallejo girl in 2000





Fran McTamaney, Environmental Education Coordinator for the San Francisco Bay NWR Complex educates visitors at the April 2000 Earth Day Event in Concord, staffing the San Pablo Bay NWR booth

Jim Griffin, Maintenance Worker for the San Francisco Bay NWR Complex finalizes repairs for the new temporary headquarters for the San Pablo Bay National Wildlife Refuge





Volunteers attend the Volunteer Recognition, Open House, Pot-luck and Awards luncheon celebrating the many contributions made by Refuge volunteers and celebrating the new temporary headquarters completion of the San Pablo Bay National Wildlife Refuge

Steve Krival from Oakland, son of Molly Krival, 1999 National Wildlife Refuge System Volunteer of the Year recipient, enjoys a weekend field-trip of the San Pablo Bay National Wildlife Refuge





Depressions in the tidelands leased from the State accumulated massive amounts of flotsam (lumber debris). California Conservation Corps crews removed the materials by hand and piled it for easy loading and disposal.





Cathy Osugi, Regional Wildlife Biologist, Marge Kolar, Project Leader, Howard Stark, Realty Specialist, Terry Nevins, Coastal Conservancy, and Jones & Stokes employees attend a site-visit of Ammo Hill on Hamilton AirField as part of the planning effort to establish the Marin Baylands National Wildlife Refuge (above)

Jim Griffin, Jim Millholland, Jeff Biles, and Bryan Winton (L-R) pose fronting the newly erected San Pablo Bay National Wildlife Refuge entrance sign on Mare Island in January 2001



ELLCOTT SLOUGH NATIONAL WILDLIFE REFUGE

Santa Cruz County

ANNUAL NARRATIVE REPORT

Calendar Year 2000

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

REVIEWS AND APPROVALS

ELLCOTT SLOUGH NATIONAL WILDLIFE REFUGE

Santa Cruz County, California

ANNUAL NARRATIVE REPORT

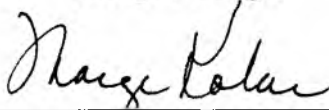
Calendar Year 2000



Refuge Manager

12/5/02

Date



Refuge Complex Manager

12/9/02

Date

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INTRODUCTION

Ellicott Slough National Wildlife Refuge (Refuge) was established in 1975 for the protection of the endangered Santa Cruz long-toed salamander. Of the seven known locations where this species can still be found, the refuge may possibly support the largest remaining population. Management objectives are to protect the site from human disturbance and to enhance upland habitat.

The Refuge consists of 170 acres of upland oak woodland and willow thickets, mostly acquired between 1975 and 1978. In 1994, an additional 6 acres of upland was purchased along with 8 acres of habitat easement by the U.S. Fish and Wildlife Service (Service). In 1999, an additional 31 acres, known as the Calabasas Unit was acquired. The Refuge is located in Santa Cruz County, 0.5 mile inland from Monterey Bay and 4 miles west of Watsonville on San Andreas Road. Combined with the adjacent 30 acres of State land, the area is managed in cooperation with the California Department of Fish and Game. The salamander breeds in Ellicott Pond on State land as well as the Calabasas Pond on Service land. It breeds in the winter rainy season and spends the remainder of the year in the valley and hillside habitat surrounding the ponds.

Ellicott Slough National Wildlife Refuge is closed to the public in order to protect salamander habitat from disturbance.

The Santa Cruz long-toed salamander grows to about 5 inches in length and has relatively long, tapered toes. It is shiny black, with an irregular pattern of metallic orange to yellow gold blotches along the back. Adults spend most of their life under leaf litter or in animal burrows aestivating. During their active periods, which are triggered by rainfall and ground moisture, they feed on beetles, centipedes, earthworms, isopods and spiders.

Adult salamanders leave their upland habitat at the onset of the rainy season in late November/December and begin their annual nocturnal migration to the breeding ponds. Males usually migrate to pond sites one to several weeks before the females. As females enter the pond, they pair with males, court, and breed. Eggs are deposited singly or in small clusters on submerged vegetation. Most adults leave the pond in March or April and return to the same general upland areas they came from. Eggs hatch in two to four weeks and develop into metamorphs in three to four months. Metamorphosis occurs after larvae reach approximately 1-1/4 inches in length. As the ponds dry, juvenile salamanders migrate back to nearby uplands.

A. HIGHLIGHTS

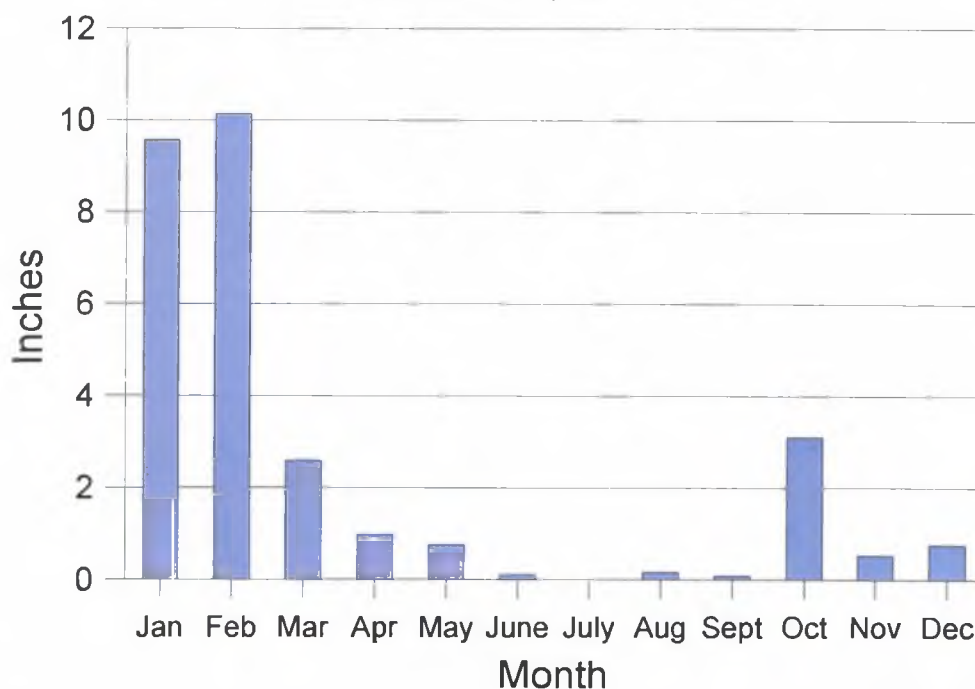
- The eleven large eucalyptus trees along the Refuge's access road were felled and removed (See section F-1).
- Chytrid fungus was discovered at the Calabasas Unit pond (see section G-2).
- CDF work crews continued clearing of downed eucalyptus material (see section F-1).

B. CLIMATE CONDITIONS

Weather conditions on the refuge are greatly impacted by the influence of Monterey Bay. Winters are generally cool and wet while summers are typically warm. This year was slightly above average in the amount of precipitation. Total precipitation in 2000 was 28.79" (www.wrcc.dri.edu) Average rainfall for Watsonville is approximately 22".

Monthly Rainfall Totals 2000

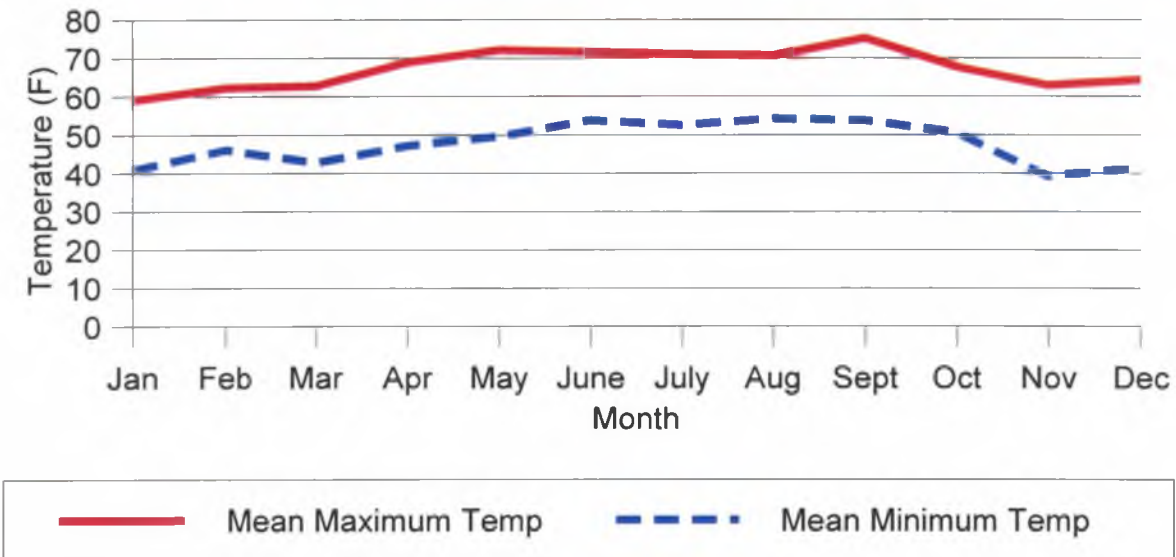
Watsonville, CA



The latter part of the 1999-2000 winter season (Jan-March 2000) experienced above average rainfall. And, although the following winter season began with a relatively wet October, there was very little rainfall in November and December.

Monthly Mean Temperatures 2000

Watsonville, CA



Other than a slightly colder than average November, the 2000 calendar year recorded fairly typical mean temperatures.

C. LAND ACQUISITION

1. Fee Title

Signs were put up on the newly acquired (September 1999) Calabasas property. This 31 acre parcel contains a Santa Cruz long-toed salamander breeding pond. A boundary survey was never conducted and it was, therefore, not possible to post the boundary line. The acquisition was completed with the assistance of Trust for Public Land (TPL). California Department of Fish and Game assisted with the acquisition process, and the funds came primarily from the Wildlife Conservation Board (WCB) and a state transportation grant. Refuge staff also met the immediate neighbors of Calabasas who gave their verbal permission allowing staff to park on their property.

The Refuge continued to work with the TPL on the acquisition of the 289-acre Buena Vista property. The site is relatively pristine, with few non-native plants. It contains a Santa Cruz long-toed salamander population and breeding pond, one of only five known populations of the endangered robust spineflower (*Chorizanthe robusta*), and a population of the rare Hooker's manzanita (*Arctostaphalus hookerii ssp. hookerii*). There is also a house, previously a caretaker's quarters, on the property. The previous owners prepared a Habitat Conservation Plan for a golf course and resort on this site. The Section 10 permit, as submitted, was not granted.

After receiving opposition from the local government and members of the public on the golf course proposal, the landowners became interested in working with TPL to sell the property. TPL contracted an appraisal of the property in December. It was appraised as four estate size lots.

Another potential acquisition that the Refuge continued to be involved with in 2000 was the Farm Services Agency (FSA) property on Harkins Slough. The property is 116 acres, approximately 40 acres are never dry and have remained unfarmed. The slough is reclaiming some land, but some of the higher ground is still farmed. The previous owners (Bencich) defaulted on a loan and FSA reclaimed the property in 1994. FSA does not consider the property to be economically viable as a farm. The Bencich's exhausted their buy back options, so FSA considered it as surplus property. There are contaminant issues on the property such as unidentified old containers and old equipment in an area where contaminants could runoff into the slough. There is also a lot of junk on the property such as old vehicles, farm equipment, five trailers, and scrap metal. Santa Cruz County cited the landowner with violations and civil penalties for illegal mobile homes and other violations. FSA is required to clean up the property. FSA has allowed the Bencichs to remain on the property because of promises to clean up the property and haul out the trailers and junk. This clean up has been ongoing for several years. Although the initial FWS recommendation in 1995 was to acquire an easement on part of the property, by the end of 2000, the Refuge is interested in acquiring the property in fee-title and working with FSA to accomplish that. However, the Refuge is not willing to take the property until it is cleaned up.

D. PLANNING

2. Management Plan

The Ellicott Slough Comprehensive Conservation Plan is scheduled to begin in 2005.

3. Public Participation

Neighbors were sent a letter from the Refuge in February to inform them that California Department of Forestry (CDF) work crews would soon be continuing their seasonal work on the Refuge.

Neighbors were sent another letter in July to inform them of the large eucalyptus removal project scheduled to begin in September. They had received a similar notice in October 1999. The July letter explained why the project had been delayed, why the trees needed to be removed, and what other work would be done in the area.

Neighbors were sent another letter in September to inform them that the eucalyptus removal project would begin September 25th and that the access road may be closed for short periods of time.

4. Compliance with Environmental Mandates

The Refuge needed to obtain a Santa Cruz County Heritage Tree Permit in order to remove the eleven large eucalyptus trees along the access road. The Federal government is exempt from this permit, but eight of the trees were on California Dept. of Fish and Game's land. The Refuge also completed a Categorical Exclusion for the project and a Section 7 consultation, which also included the corner stump removal and berm construction project by maintenance staff.

5. Research and Investigations

The Wildlife Health Lab in Madison, Wisconsin, was sent a sample of SCLTS larvae from the Calabasas Pond. The larvae were analyzed for disease/parasites. They were found to be infected with chytrid. More information is provided under the Endangered and/or Threatened Species heading.

E. ADMINISTRATION

1. Personnel

Ellicott Slough is administered as a subunit of San Francisco Bay National Wildlife Refuge Complex. As such, no personnel are stationed full time at this site. However, two staff members at the San Francisco Bay NWR Complex have the primary responsibility for this Refuge (as well as for Salinas River NWR). Chris Barr was the Refuge Manager until July 2000 when he took a position at another station. Ivette Loredo was the biologist working with Chris. In August of 2000, Ivette became the Refuge Manager. Diane Kodama was hired in November of 2000 for the biologist position.

3. Other Manpower Programs

The Refuge continued its partnership with the California Department of Forestry (CDF) and their Ben Lomond Youth Conservation Camp. CDF oversees the inmate crews on habitat projects and wildfire suppression. CDF has been working at Ellicott Slough NWR since 1997.

5. Funding

In addition to a portion of the Complex's base funds, Ellicott Slough NWR received a Challenge Cost Share grant in 2000 for \$10,000. This grant was for habitat enhancement for the long-toed salamander. One third of the funds were used to help pay for the large eucalyptus removal project. Remaining funds were used to purchase coast live oak trees, including 18 large trees

(24" box) to replace the large eucalyptus along the access road, as well as various planting supplies. Trees purchased with these funds were planted in early 2001.

6. Safety

No safety incidents occurred.

F. HABITAT MANAGEMENT

1. General

In March, native species were planted in oak woodland and riparian sites including 37 buckeye, 5 wax myrtle, 2 arroyo willow, and 3 redwoods. These were all propagated in the native plant nursery at the Refuge.

CDF work crews continued their seasonal work on the Refuge in 2000. Much of their work involved cleaning up downed material left over from a major eucalyptus removal project that occurred in the summer of 1997 by Planned Sierra Resources as well as cleaning up after their own eucalyptus removal work. They cleared downed material on the Lansdale property, cleaned up rounds of wood on the Lansdale hillside, the south side hill, and near the entrance, and chipped brush piles. This work was a result of the mistaken removal of trees on Lansdale's property by Planned Sierra Resources. Rounds were cut into firewood and placed near the Refuge entrance for neighbors. CDF worked every day through March, then 4 days per week as the weather dried up.

In the fall of 2000, the eleven large eucalyptus trees along the access road were removed by Dave Allen Tree Services. Several of these large trees had fallen across the road during winter storms over the past few years, and they were considered a hazard. Eucalyptus are shallow-rooted trees and often pose fall hazards. The Refuge thus prepared NEPA (categorical exclusion) and Section 7 documentation. Staff met onsite with Walt Sadinski and Amelia Orton-Palmer of the Ventura ES Office to discuss how to remove the trees with the least potential for harm to the long-toed salamander. It was decided that the three trees on the south part of the road and the four on the north side that were leaning south could be felled in one piece. They would be felled, cut, and removed one at a time while trying to minimize the footprint of impact. The four trees leaning to the north toward the pond would be cut in sections to minimize the impact near the pond. The project started on September 27th and was completed on Oct. 19th. On the first day, Ivette Loredó gave the contractor an orientation on the salamander, red legged frog, and California tiger salamander. He was also instructed to avoid damaging oaks, coffeeberries, blackberries and other native vegetation to the extent possible. They started on the south side of the road so there were no road closures. They installed 'Prepare to Stop' signs at each end of the road, so neighbors would slow down. The contractors were supervised by a biologist during the entire project. The Refuge was able to hire Ross Wilming, the former intern at Ellicott Slough, as an

emergency hire for 2 months to prepare and oversee the project. Work was completed satisfactorily.



Access road prior to eucalyptus removal



Digging trenches around trees to be removed.



Tree removal work in progress.



Removal of biomass.

Issues with the large eucalyptus tree removal project were brought up by two neighbors at Ellicott prior to project initiation. In October 1999, the project was delayed due to concerns from two neighbors, Dixie Allen and Bob Shelts, and their request to review the environmental documentation. Due to the quickly approaching rainy season, the project was put off until summer or fall of 2000 to avoid impacts to the salamander. In July of 2000, Ms. Allen and Mr. Shelts (housemates) were sent letters updating them on the status of the environmental documentation and explaining why the trees were to be removed. The letters also invited them to contact the Refuge if they wished to discuss the issue further. Approximately three weeks later in July Ms. Allen ran into and spoke to Marc Webber, Deputy Project Leader, at the Refuge and claimed that the removal of the eucalyptus would diminish her property values, that the eucalyptus were not a hazard and should not be removed, and that they were only a hazard because our previous upslope tree removal project had increased runoff to the area. She questioned our planning process. She said she was getting petitions from the community (aside from the immediate neighbors). In mid-August, Bob Shelts called to talk to Marc Webber and Ivette Loredó. He wanted to express a general dissatisfaction with Refuge staff. He felt we made promises we did not keep, such as leaving the eucalyptus trees along the road. He said the reason we now consider them a “hazard” is because of the tree removal we did upslope that caused increased runoff. He was “frustrated with us”, but had decided not to continue to actively block our plans to remove the trees because: he did not believe he could legally stop us, the other

neighbors were not as motivated, and he had no time. We apologized for the lack of communication, especially given the employee turnover of recent years. We encouraged him to continue to communicate with us. Although the Refuge sent written communication to all the adjacent neighbors as the tree removal project drew near, we heard nothing further from either Mr. Shelts or Ms. Allen for the remainder of the year.

2. Wetlands

Ellicott Pond and Calabasas Pond stayed wet well past May, allowing time for salamander metamorphosis. Prospect Pond, a pond that was constructed in 1996 and has yet to be used by salamanders due to poor design, was almost dry by mid-May.

3. Forests

On March 3, the Refuge and California Department of Forestry (CDF) crew planted 100 coast redwood (*Sequoia sempervirens*) seedlings on Michael Lansdale's property thus completing compensation for 30 eucalyptus trees that were inadvertently removed on his property in 1997 due to the poorly marked Refuge boundary. Prior to the planting, and in response to Michael Lansdale's request, eucalyptus stumps and shoots were treated so as to minimize regeneration. The Refuge will not be responsible for the success of the seedlings.



Redwood plantings on Lansdale property.

6. Other Habitats

Oak Woodland - In January, acorns were planted at approximately 35 sites (3 per site) on the south side of the Refuge along the railroad tracks, where eucalyptus resprouts were recently sprayed. Each site was tagged, marked with blue flags, and mapped.

10. Pest Control

About 10 gallons of round-up were sprayed on eucalyptus, hemlock, New Zealand spinach, and mustard in September. The Ezject lance, which propels herbicide capsules into tree trunks, was used on larger eucalyptus seedlings. Approximately 10% of the eucalyptus survived the treatment and were retreated in November.

In 2000 the Refuge began to examine mosquito control practices on Ellicott Pond because of recent studies on the potential effects of methoprene, a mosquito control chemical, on amphibians. It was resolved with Ventura Fish and Wildlife Office that in light of new studies a formal Section 7 consultation was necessary in order to evaluate the effects of mosquito abatement activities. However, the pond is on State land and the Refuge's Memorandum of Understanding (MOU) with the State is out of date. After much discussion with the Ventura Office, the resolution was made to rewrite the MOU and then initiate a Section 7 consultation. In the meantime, both Fish and Game and the Service asked the mosquito control district not to spray in Ellicott Pond. They were allowed to continue spraying in the ditches along the KOA and by the Railroad. Mosquito abatement in the area is primarily conducted for human nuisance; encephalitis mosquitos only breed at Ellicott when the pond holds water into July, which is only during really wet years. Refuge staff completed a draft Section 7 request but did not submit it in 2000 because the MOU with the State still needs to be updated.

G. WILDLIFE

1. Wildlife Diversity

The Refuge provides habitat to various migratory birds, as well as resident birds, small mammals and deer. However, the Refuge is located in an area of intense farming in Santa Cruz County. Many of the surrounding valleys and hillsides are used for greenhouses, farmed for strawberries and raspberries, or grazed by cattle. As more areas are converted to agriculture in the future, the refuge will increase in importance by retaining natural habitat for many species.

2. Endangered and/or Threatened Species

Dip-netting for SCLTS larvae was conducted on May 15 at Ellicott Pond, the KOA ditch along the Refuge's northwestern boundary, Prospect Pond, and Calabasas, as well as two off-Refuge ponds: Suess Pond and Valencia . The KOA ditch, Prospect Pond and Valencia lacked any SCLTS larva. Prospect Pond was just a couple of shallow puddles at the time of the survey. Numerous healthy long-toed larvae were found in Ellicott Pond and Suess Pond (adjacent to the Calabasas Unit). California tiger salamanders were also found at Ellicott Pond. Numerous larvae were also found in Calabasas, but many appeared unhealthy. Salamanders at Calabasas were emaciated, some had skin problems, and many had truncated tails. Two crawfish were discovered for the first time in Calabasas pond and were removed due to their predatory behavior on the SCLTS.



Larval survey at Ellicott Pond.

Refuge staff spoke to the Ventura Office and decided to collect SCLTS larvae from Calabasas for lab analysis. Dip-netting of Calabasas was again conducted on May 30. About 20 SCLTS larva were found. The majority of larva looked healthy this time, although a few were quite small. Ten SCLTS larvae and one red-legged frog larva from Calabasas were sent to the Madison Wildlife Health Lab for analysis. A third crawfish was caught and removed from the pond. The Health Lab analyzed the larvae and found chytrid fungus in the red-legged frog tadpole and some of the salamander larvae. Chytrid kills frogs but not salamanders. Salamanders can be carriers, however. The emaciated condition was not caused by the chytrid. The tail trauma was probably caused by the crawfish or by cannibalism.

On December 5th, letters were delivered to Calabasas neighbors explaining the Refuge purpose and requesting that they stay out of the pond. It explained the danger of spreading chytrid fungus to other amphibian breeding ponds.

3. Waterfowl

Mallards and gadwall use the Refuge ponds occasionally.

6. Raptors

Raptors using Ellicott Slough NWR include northern harrier, cooper's hawk, sharp-shinned hawk, and red-tailed hawk.

7. Other Migratory Birds

Black phoebes, Bewick's wren, California towhees, white-crowned sparrow, western meadowlark, scrub jay, mockingbird, swallows, woodpeckers, and warblers are regularly seen on the Refuge.

8. Game Mammals

Ellicott Slough provides habitat for mule deer.

10. Other Resident Wildlife

Pacific treefrogs, California tiger salamanders, arboreal salamanders, Ensatina salamanders, California slender salamanders, fence lizards, alligator lizards, western aquatic garter snakes, gopher snakes. California quail. Racoons, rabbits, gray fox, striped skunk, coyote, Botta's pocket gopher, voles, deer mice, moles, western gray squirrel.

14. Scientific Collections

Ten SCLTS larvae and one red-legged frog larva were sent to the Madison Wildlife Health Lab for analysis.

17. Disease Prevention and Control

As a result of the chytrid fungus in Calabasas, Refuge staff has taken further precautions to disinfect nets and waders between ponds. Staff also consulted with the mosquito abatement district and instructed them of the proper disinfection techniques between ponds. They were very cooperative.

H. PUBLIC USE

1. General

The Refuge is closed to the public, although occasional tours or interpretive events do occur.

6. Interpretive Exhibits/ Demonstrations

Refuge staff assisted the Ventura Fish and Wildlife Service at the Santa Cruz County Fair in September 2000. The Service had a booth set up to provide information on local endangered species. Refuge staff also provided information on Ellicott Slough NWR.

17. Law Enforcement

There were no law enforcement issues in 2000.

I. EQUIPMENT AND FACILITIES

2. Rehabilitation

The levee for the Calabasas Pond was breached during the El Nino winter of 1997/1998. It was temporarily fixed by Fish and Game in 1999 with rip rap. In 2000, prior to pond filling, Refuge staff repaired the levee again with sand bags and a tarp. This is another temporary fix until the Refuge can get maintenance funds to permanently fix it. Large holes have been scoured out on both sides of the levee.



Calabasas levee repair.

3. Major maintenance

In the fall, the manager met with maintenance at Ellicott to talk about a large project to clear up the corners of the entrance. This will involve cutting up and removing several large remaining eucalyptus stumps and trunks, clearing the fence line area, building a berm at the southwest corner of the access road to prevent flooding of the railroad, installing a Refuge sign at that southwest corner, and constructing a more formal-looking entrance. Maintenance started work there on Oct. 25, but it began to rain so they could not complete the process. They were able to start but not finish the berm. They will resume in April if the ground is dry enough. They were able to add gravel and smooth out the road by the entrance.

7. Other

Some fence repair work was done in November.

J. OTHER ITEMS

2. Items of Interest

On December 19th, Dave Paullin, the CA/NV Refuge Supervisor, toured Ellicott Slough and Salinas River. He was also shown the Buena Vista site and the FSA property on Harkin Slough, Bencich property.

3. Credits

Author: Refuge Manager Ivette Loreda

Reviewers: Refuge Complex Manager Marge Kolar
Deputy Project Leader Mike Parker

SALINAS RIVER NATIONAL WILDLIFE REFUGE

Monterey County

ANNUAL NARRATIVE REPORT

Calendar Year 2000

U.S. Department of the Interior

Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

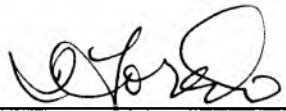
REVIEWS AND APPROVALS

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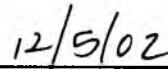
Monterey County, California

ANNUAL NARRATIVE REPORT

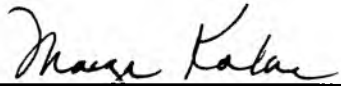
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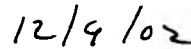
Refuge Manager



Date



Refuge Complex Manager



Date

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INTRODUCTION

Salinas River National Wildlife Refuge (Refuge) encompasses 367 acres located 11 miles north of Monterey, California at the point where the Salinas River empties into Monterey Bay. The Refuge is part of the San Francisco Bay National Wildlife Refuge Complex, headquartered in Fremont, California.

Refuge lands include a range of terrestrial and aquatic habitats, including coastal dunes and beach, grasslands, wetlands, and riparian scrub. Because of its location within the Pacific Flyway, the Refuge is used by a variety of migratory birds during breeding, wintering, and migration periods. It also provides habitat for several threatened and endangered species, including the endangered California brown pelican, Smith's blue butterfly, and Monterey gilia, and the threatened western snowy plover and Monterey spineflower.

The Refuge is open to the public and current uses include wildlife observation and photography, and waterfowl hunting. The Refuge is also used to access the beach for surf fishing. Those willing to walk from the parking lot to the beach are rewarded with beautiful scenery and an excellent display of native dune vegetation.

The refuge was acquired in 1973 through a transfer of surplus military land from the U. S. Army and the Coast Guard. From 1974 through 1991, what is now the Refuge was operated as a Wildlife Management Area under a cooperative agreement with the California Department of Fish and Game. By the mid-1980s, growing awareness of the Refuge's importance as habitat for sensitive species prompted a shift toward more active management and protection of its resources. In 1991, the Service began managing the area as a National Wildlife Refuge.

Since 1991, Refuge management efforts have focused on sensitive species protection, habitat restoration and enhancement, and public use management.

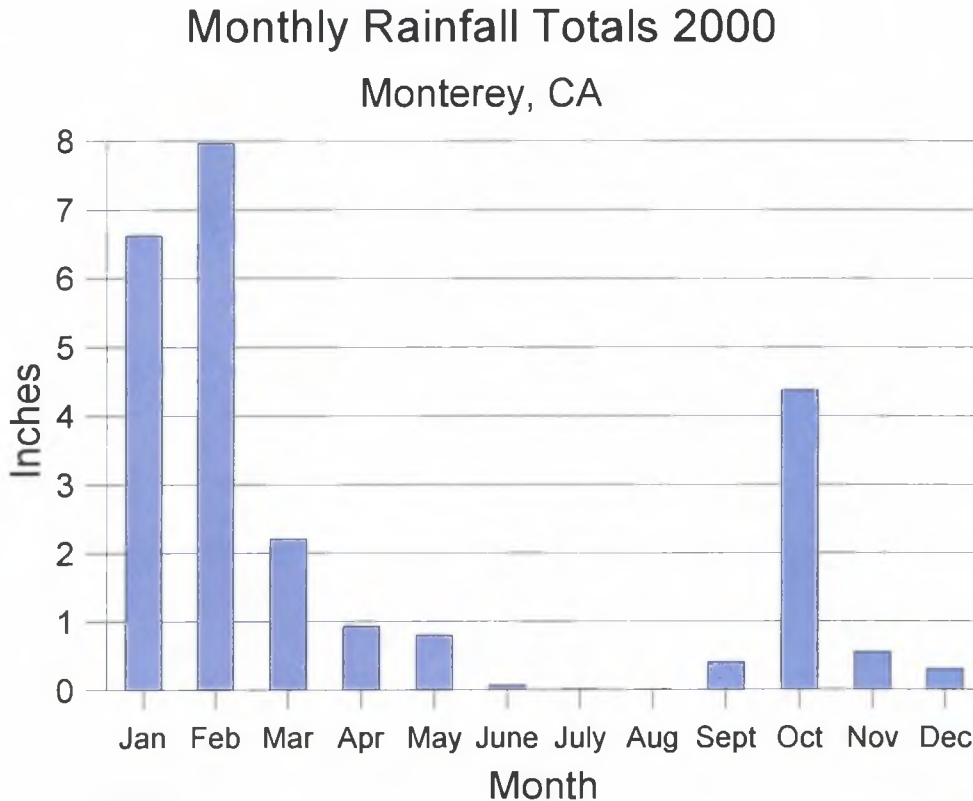
A. HIGHLIGHTS

Continued work towards the completion of the Salinas River National Wildlife Refuge Comprehensive Conservation Plan (CCP).

The second year of an experimental avian predator relocation program was completed with Santa Cruz Predatory Bird Research Group.

B. CLIMATIC CONDITIONS

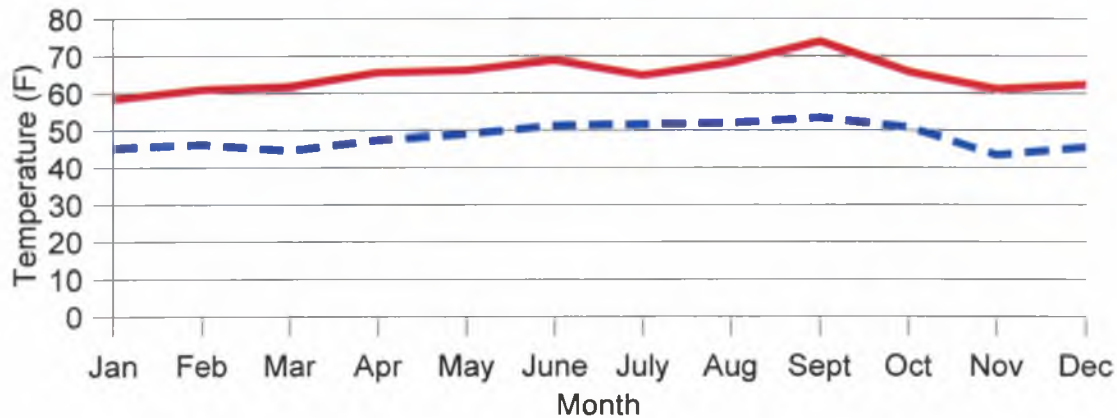
Weather conditions on the refuge are greatly impacted by the influence of Monterey Bay. Winters are generally cool and wet while summers are typically warm. This year was slightly above average in the amount of precipitation. Total precipitation in 2000 was 24.25" (www.wrcc.dri.edu/cgi-bin/cliMONtpre.pl?cantry) Average rainfall for Monterey is approximately 20".



The latter part of the 1999-2000 winter season (Jan-March 2000) experienced above average rainfall. And, although the following winter season began with a relatively wet October, there was very little rainfall in November and December.

Monthly Mean Temperatures 2000

Monterey, CA



Seasonal temperature variation is low as is typical of the central California coast. Other than a slightly colder than average November, the 2000 calendar year recorded fairly typical mean temperatures.

C. LAND ACQUISITION

3. Other

Big Sur Land Trust (BSLT) acquired a 66% undivided interest in the Martin property, including coastal dunes, immediately south of the Refuge. Various members of the Martin family will continue to own 33% undivided interest in the property. The land is shared, so there are no ownership boundaries. The Martin family allows ATV use on the property, but BSLT is trying to educate them on conservation issues. Currently, ice-plant control (through a FWS Partners for Wildlife grant and California State Parks personnel) and predator management (through an agreement with U.S. Department of Agriculture Wildlife Services) occur on the Martin property. In addition to the dune habitat, there are several wetland hollows on the property with wetland associated plants such as *Juncus*, *Scirpus*, willow, yarrow, creeping wild rye, and *Polygonum*.

D. PLANNING

2. Management Plan

The Comprehensive Conservation Plan (CCP) process was started for Salinas River NWR in December of 1999. In 2000, Refuge staff continued working on development of the CCP with Mark Pelz from the Sacramento Planning Office and Jones and Stokes, a contractor hired to write

and coordinate the CCP. In February, Refuge staff held a conference call with Realty and Planning staff (Richard Hadley, Steve Dyer, Don Delong, Chuck Houghton) to discuss whether to do the Land Protection Plan (LPP) for the Martin and LoneStar properties and expand the approved refuge boundary as part of the CCP. It was decided for to have the CCP only concerned with the refuge because the LPP would complicate the process and could delay completion of the CCP.

On March 2nd, we held a meeting with our partners, California Department of Fish and Game, Point Reyes Bird Observatory, California Department of Parks and Recreation, and the Watershed Institute to listen to concerns about Refuge management. We had many valuable comments. Recurring comments included: questions about whether the Service could manage increased public use; concern that any improvements to facilities would bring increased use; the need for increased Service presence at the Refuge, both with law enforcement and biology staff; and the need to make the refuge larger for wildlife protection by acquiring Martin & LoneStar.

On June 1st, the Service held a public scoping meeting for the Salinas River CCP. Only a few people, including PRBO staff, and a Fish and Game warden showed up. The meeting was advertised in local newspapers and was posted at the Refuge entrance, but there was little interest. We received some comments.

On August 8th, the first administrative draft of the CCP was completed by Jones and Stokes for internal FWS review. Refuge staff reviewed and sent comments as did the Ventura Endangered Species Division and other FWS staff.

In August and September, Refuge staff and Mark Pelz of the Sacramento Planning Office conducted site visits to the Refuge to map vegetation types with a GPS. The vegetation map will be part of the CCP (Figure 1).

3. Public Participation

As mentioned above, the public scoping meeting for the Salinas River NWR CCP was held on June 1, 2000. There was little public participation.

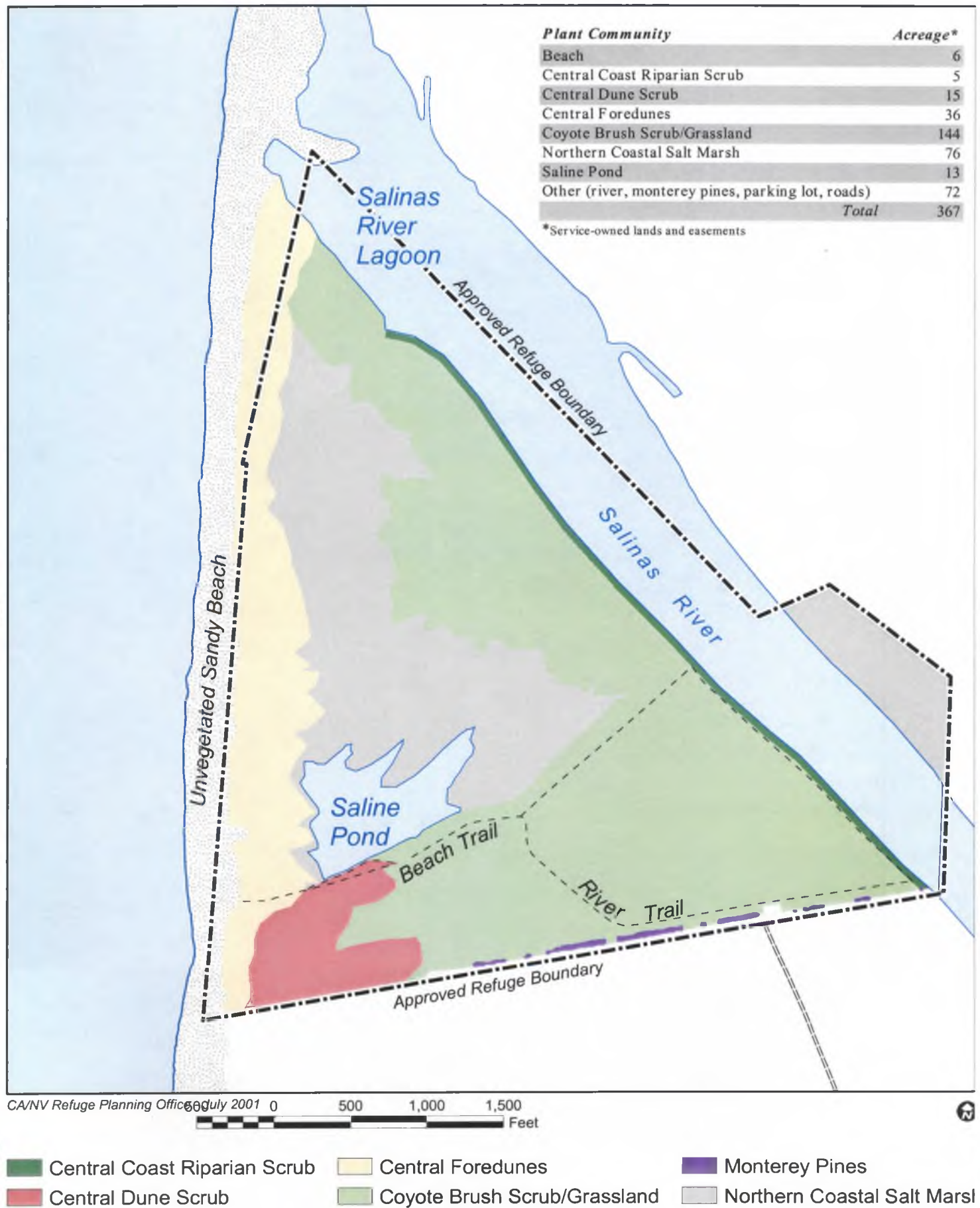
5. Research and Investigations

Point Reyes Bird Observatory (PRBO) continued their long-term study of snowy plover breeding success in Central Coastal California. PRBO worked closely with refuge staff on coordinating the snowy plover predator management program.

During the CCP development process, Refuge staff received conflicting information on the location of the actual Refuge boundary. First, Scott Wise from Regional Office Realty confirmed that the Salinas River NWR boundary extends into the ocean, as shown on Refuge maps drawn by the Service's Cartography Office. Scott stated that when the military owned the land they asserted exclusive federal jurisdiction for law enforcement activities, requiring a boundary out to

the water. When the land was transferred, that was changed to concurrent jurisdiction but no land was relinquished to the state. Refuge staff also began to look through the Salinas NWR realty files. The files seemed to show that the Service did own out into the water. However, in conversations with the State Lands Commission, they did claim that lands below mean high water reverted back to them by default once the area was converted from military ownership. Dave Plumber from State Lands Commission said that when the Army condemned land at the Refuge site, it only condemned up to mean high water. But under an 1897 statute in CA, they were given control of lands 300 yards offshore for military purposes. The statute, however, states that this control is only for military purposes. So when they turned over the land to the DOI, they should not have turned over those lands. The tidelands would have defaulted back to the state. Realty said we would need a Solicitor's Opinion to finally settle it. Steve Dyer submitted a request to the Solicitor's Office. Note: The issue was not settled until early 2001 when the Solicitor's Office issued their opinion that the Service only owned lands to the mean high-water mark.

Figure 1. Vegetation Map



E. ADMINISTRATION

1. Personnel

Salinas River National Wildlife Refuge is administered as a satellite station of San Francisco Bay NWRC. As such, no personnel are stationed full-time at the site. However, two staff members at the San Francisco Bay NWR Complex have the primary responsibility for this Refuge (as well as for Ellicott Slough NWR). Chris Barr was the Refuge Manager until July 2000 when he took a position at another station. Ivette Loreda was the biologist working with Chris. In August of 2000, Ivette became the Refuge Manager. Diane Kodama was hired in November of 2000 for the biologist position.

4. Volunteer Programs

The Snowy Plover surveys conducted by PRBO were contributed as a volunteer activity throughout the year.

Volunteers also assisted with trash and litter pickup around the parking and beach areas for Coast Clean-up in September. Crews were organized by State Parks staff and trash was bagged and left at our beach trail. Refuge staff picked up and disposed of trash the following week.

5. Funding

In addition to a portion of the Complex's base funds, Salinas River NWR received two Challenge Cost Share grants in 2000. One was for \$7240 for experimental avian predator management using PRBO's volunteer time as the cost share. This was obligated to the Santa Cruz Predatory Bird Research Group for their activities over the snowy plover season. The other grant was for \$10,000 for general habitat enhancement and snowy plover protection. It used Watershed Institute's labor as the cost share. Funds were used for sensitive habitat signs, herbicide for weed control, symbolic fencing supplies, and an ATV trailer to haul supplies along the beach.

6. Safety

No safety incidents occurred.

F. HABITAT MANAGEMENT

1. General

Salinas River NWR is comprised of several unique habitat types including saline pond, central dune scrub, central foredunes, coyote brush scrub/grassland, northern coastal salt marsh, and central coast riparian scrub. Quality of the habitat found on the dunes and beach is very good. Salt marsh areas have been altered by changes in the water regime in the Salinas River over the past several decades. Irrigation draws off a major portion of freshwater inflow and flood control

practices (i.e. breaching the front beach and channelization) have changed the hydrology. Much of the grassland habitat is gradually being restored after years of cultivation prior to refuge establishment.



Aerial view of Refuge showing dunes in foreground, saline pond, and Salinas River in background.

2. Wetlands

The 15-acre saline pond on the Refuge is a permanent saline wetland bordered by pickleweed salt marsh. Water sources for the pond include a high water table, rainfall, surface drainage from adjacent agricultural fields, surf overwash of the low dunes and occasional flooding of the Salinas River. The area is extremely attractive to shorebirds, waterfowl, and other water-associated birds.

The Salinas River was manually breached by the Monterey County Water Resource Agency on January 24, 2000. Dave Dixon, of State Parks, supervised the breaching to ensure that sensitive resources were not harmed. Access to the breaching site is through the Salinas River State Beach, just north of the Refuge. Breaching is conducted in the winter to prevent flooding of agricultural lands adjacent to the river.

The Watershed Institute (WI), out of California State University Monterey, has partnered with the Service and has been conducting riparian restoration on the Refuge since 1996. In 2000, they put up four erosion control points along the river and set four others 15' in from these to monitor bank erosion. Two of the four along the river were lost due to erosion within a matter of three weeks in January and February. Extensive restoration along the river included plantings of cottonwood, red willow, sandbar willow, box elder, sycamore, alder, and coyote bush.

Monitoring of plantings has been primarily to replace dead trees, not to record survival. Trees need to be kept caged for a few years to protect them from deer (browsing and rubbing antlers on trees). WI continued to experiment with different exclosure types and has determined that sturdy steel mesh cages around trees provide the best protection. Although WI has been funded with Challenge Cost Share grants in the past, in 2000 they were funded with a Packard Foundation grant.

5. Grasslands

Grassland areas on the Refuge are interspersed with scrub habitat. The Watershed Institute (WI) has also been involved with grassland restoration efforts on the Refuge. WI drill-seeded native grasses on 25 acres in 1996. WI currently maintains the area by regular mechanical mowing three to four times each year and intensive weed-whacking to control non-natives such as wild radish, mustard, and hemlock. The grassland restoration goal is to have approximately 40 acres planted with *Elymus glaucus*, *Hordeum brachyantherum*, *Deschampsia caespitosa*, and *Bromus carinatus*. Additional seeding will be necessary.

6. Other Habitats

For its size, the Refuge has a very diverse mosaic of habitat types. The beach and low dunes provide feeding and resting areas for many shorebirds such as sanderlings, sandpipers, willets, marbled godwits, and other waterbirds. Snowy plovers nest here and, historically, California least terns, an endangered species, nested on the beach. The high dunes contain many herbaceous and woody shrubs that come alive with colors during the spring. The high dunes provide habitat for many small mammals and resident birds such as California quail. Raptors commonly forage for prey in the dunes and grassland areas.

10. Pest Control

Round-up herbicide treatments were applied this year to monotypic patches of iceplant and European beach grass in the dune areas. The program has produced excellent results. The upper dunes are virtually free of iceplant, with just a few remaining isolated patches in the lower dunes and along the saline pond. Iceplant should be eradicated in several years with consistent herbicide treatments. Those benefitting include the endangered Smith's Blue butterfly, the threatened snowy plover, the black legless lizard, and a variety of endangered and native plants.

Mosquito control is conducted on the Refuge by the Northern Salinas Valley Mosquito Abatement District. In 2000, three treatments of Bti were applied to the Saline Pond, on February 4th, March 9th, and March 24th.

G. WILDLIFE

1. Wildlife Diversity

Salinas River NWR has a diverse array of wildlife species using the various plant communities. The upper dunes support a diversity of plant types that host many species of insects including the endangered Smith's blue butterfly. The black legless lizard (*Aniella pulchra nigra*), a State species of special concern also occurs here.



Black legless lizard
(*Aniella pulchra
nigra*)



Smith's blue butterfly
(*Euphilotes enoptes*)

Several raptor species use the refuge, especially during the winter months, and many passerine species use the refuge during migration. Shorebirds and waterfowl are seen on the refuge year round.

2. Endangered and/or Threatened Species

Endangered California brown pelicans commonly roost on the sandbar at the mouth of the Salinas River. These birds are present from April through December, arriving from the south after breeding in southern California and Mexico.

The Federally endangered Smith's blue butterfly (*Euphilotes enoptes*) occurs on the dune habitats of the refuge where there is an abundance of their host plants, coastal buckwheat (*Eriogonum latifolium*) and seacliff buckwheat (*Eriogonum parvifolium*).

The Point Reyes Bird Observatory (PRBO) continued their long term study of the threatened western snowy plover (*Charadrius alexandrinus nivosus*) throughout Monterey Bay. John and Rikki Warriner, PRBO volunteers, have been studying western snowy plovers since 1977 and have been documenting plover breeding success at SRNWR since 1983. They attempt to color band all breeding adults and chicks at the Refuge in order to monitor the birds annually.



Western snowy plover

On February 7th, the Monterey Working Group snowy plover coordination preseason meeting was held. This meeting includes all the partners in snowy plover management in the Monterey Bay including State Parks, CA Dept. of Fish and Game, PRBO, USDA Wildlife Services, Santa Cruz Predatory Bird Research Group (SCPBRG), FWS Refuge Staff, and FWS Endangered Species Division. The meeting began with discussion of avian predator management and the group reviewed comments on the revised Experimental Avian Predator Management Plan and the cooperative agreement with SCPBRG. There was some discussion on how much could be

accomplished based on funding. Other coordination items discussed included mammalian predator management, breeding site conditions, snowy plover recovery plan and critical habitat designation update, Moss Landing Salt Ponds habitat management update, and a Martin Property update.

In the 2000 breeding season, there were a total of 17 nests at the Refuge. Symbolic fencing was placed around 6 of these nests that were in danger of being trampled by Refuge visitors due to their location. However, no exclosures were erected around any of the nests. In the past few years, PRBO has observed that avian predators seem to be cuing in on exclosures and taking chicks. Also, nest abandonment of exclosed nests is higher than unexclosed nests. In contrast, loss of nests by mammalian predators has been low due to the success of the mammalian predator management program. Therefore, the Monterey Working Group is moving away from exclosure use. The hatch rate at the Refuge was a solid 76%. One nest was lost to gull trampling, one to wind, one to desertion, and one nest contained nonviable eggs. No nests were lost to mammalian predators. Fledge rates were higher than past years, but not as high as our goal of 40%. At the Refuge, removal of three of four nesting Northern Harriers was accompanied by a 28% chick fledging rate, a relatively low level compared to historical data but a relatively high level compared to the past 3 years.

The post-season Monterey Working Group snowy plover coordination meeting was held on October 12th. An overview of the breeding season was discussed. It was the best season in several years with an overall hatch rate of 86%, a fledge rate of 39%, and an average of 1.6 fledges/male (above goal of 1 fledge/male). There were 98 males and 87 females nesting, compared to 78 and 68 last year, representing an increase of approximately 25%. Adult numbers are still lower than 1998 but seem to be increasing. There were no nests destroyed by foxes this year and an increased knowledge of and efforts against raptor predation may have been contributing factors to this year's success. There was some discussion on the issue with the pet cat that was shot at Zmudowski. It was decided that even though the cat was roaming around in plover nesting areas without a collar, that trappers would no longer shoot there because of the presence of a lot of people and the potential that a cat is a pet. Other issues discussed included problems with ATV use on Martin Property, a mysterious plover die-off at Pajaro (9 adults), plans for restoration of the Salt Ponds, and the State Parks snowy plover guardian docent program.

3. Waterfowl

Waterfowl, including mallards, gadwall, ruddy ducks, and geese can be found in the Salinas River and lagoon.

4. Marsh and Water Birds

Brown pelicans, California gulls, western gulls, American coot, great blue heron, green-backed heron, great egret, snowy egret, and pied-billed grebes are found on the Refuge.

5. Shorebirds, Gulls, Terns, and Allied Species

Thousands of shorebirds use the beach, lagoon, river and marsh habitat during migration and winter. Black-necked stilts and American avocets nest near the Saline Pond. Caspian and elegant terns roost near the lagoon. Killdeer and western snowy plovers nest in the low dunes and on islands near the mouth of the Salinas River. Other shorebirds, associated either with the Saline Pond, the lagoon, or the ocean shore, include western sandpipers, sanderling, least sandpiper, marbled godwit, willet, long-billed curlew, and red-necked phalarope. Black skimmers attempted to nest at the Refuge for the first time this year. Their nest was located by the Saline Pond but was unsuccessful.

6. Raptors

Raptors on the Refuge include northern harriers, Peregrine falcons, American kestrels, white-tailed kites, loggerhead shrikes, red-tailed hawks, and barn owls.

7. Other Migratory Birds

Song sparrow, savannah sparrow, white-crowned sparrow, golden-crowned sparrow, common bushtit, warbling vireo, yellow warbler, Wilson's warbler, common yellowthroat, marsh wren, Bewick's wren, cliff swallow, barn swallow, Northern rough-winged swallow, Pacific slope flycatcher, ash-throated flycatcher, black phoebe, Downy woodpecker, Allen's hummingbird, American goldfinch, and western meadowlark have all been documented on the Refuge.

8. Game Mammals

Mule deer are common in the upland habitats of the Refuge.

9. Marine Mammals

Marine mammals of coastal waters offshore include the Southern sea otter, California sea lion, California harbor seal, Pacific white-sided dolphins, Dall's porpoise, and harbor porpoise. Whales species migrating through the area include gray whale, humpback whale, blue whale, and killer whale.

10. Other Resident Wildlife

Other resident wildlife include reptiles such as the gopher snake, common garter snake, western fence lizard, western skink, southern alligator lizard, and common king snake; and mammals such as the muskrat, beaver, gray fox, red fox, coyote, bobcat, striped skunk, Virginia opossum, raccoon, long-tailed weasel, black-tailed jackrabbit, California ground squirrel, California vole, broad-footed mole, Botta's pocket gopher, western harvest mouse, and deer mouse.

11. Fisheries Resources

The composition of fish in the Salinas River Lagoon is typical of that found in lagoon/rivermouth habitats elsewhere on the central California coast. Native fish species in the lagoon include Sacramento blackfish, Sacramento sucker, Sacramento squawfish, California roach, threespine stickleback, and the federally threatened steelhead trout. Nonnative species include carp, white bass, bluegill, green sunfish, mosquitofish, and threadfin shad.

Saltwater fish found in ocean waters by the Refuge and occasionally in the lagoon include starry flounders, staghorn sculpin, Pacific herring, topsmelt, shiner surfperch, walleye surfperch, silver surfperch, spotfin surfperch, white surfperch, surf smelt, northern anchovy, jacksmelt, English sole, and striped bass.

15. Animal Control

The Monterey Integrated Predator Management Program was initiated in 1993 by the Service, CDPR, and CDFG, in response to low snowy plover reproductive success rates. It integrates a variety of techniques, including: removal of mammalian predators, primarily non-native red foxes, feral cats, and skunks; installation of nest exclosures and symbolic fencing; and posting of informational signs. The Department of Agriculture's Wildlife Services Branch conducts removal activities.

The program has been very successful in increasing snowy plover hatch rates. Snowy plover hatch rates were high in 1999 and 2000; the 2000 overall hatch rate of 86% in the Monterey Bay was the highest recorded since monitoring began in 1984. In addition, it was possible to use fewer exclosures around snowy plover nests in the Monterey Bay area in 2000 than in the previous eight years because of the success of the mammalian predator management program. It is desirable to minimize the use of nest exclosures because avian predators learn to recognize them and use them as perches from which to prey on snowy plover chicks and adults; fledgling rates decrease and adult loss increases when nests are exclosed.

In June, the WS trapper shot a cat at Zmudowski State Beach that turned out to be a pet cat. The trapper had talked to the cat's owner, Debbie Hannas, a new plover guardian, prior to the incident and she was made aware of the trapping efforts that were occurring in the area. She said that her cat was well trained and would never go to the beach areas. The trapper was concerned that a plover guardian was allowing her cat outside, and he reported this conversation to the plover guardian coordinator for State Parks. One week later, however, the trapper was at Zmudowski at night and saw an uncollared cat walk by a trap set and proceed to a snowy plover nesting area. This area was at least 1/4 mile from the nearest residence. Because of eminent threat to plovers, the cat was shot. Based on the Debbie Hannas' description, it is believed that this cat belonged to her. As a result of this incident Hannas contacted the local press. Both Wildlife Services and FWS staff provided comments to the press. In July, the trapper was again at Zmudowski State Beach at night and ran into a man who approached him and asked about Debby Hannas' cat. He then tried to intimidate and threaten him. On August 9th, Refuge biologists Buffa, Albertson, and Loreda met with the trappers and their acting supervisor, Noel Myers. It was agreed that the

trapper acted according to protocol and made a sound decision in this incident, but that there was a need to discuss ways to further minimize take of pets (don't shoot cats in areas near houses, put up flyers to keep pets in & collared). The group also discussed the how the incident was handled.

In 2000 the Refuge contracted PRBO to conduct a study of the predator management data and write a summary report detailing the effectiveness of the program. Data from 1993-1999 was used. The analysis report is to be completed in 2001.

Because of decreased snowy plover fledge rates and continued adult loss believed to be primarily the result of avian predation, the Service and the Santa Cruz Predatory Bird Research Group, in cooperation with CDFG, CDPR, and PRBO, implemented a small-scale 3-year experimental avian predator relocation study at the Refuge and the Moss Landing Wildlife Area in 1999. The purpose of the study was to document the effects of avian predators on snowy plovers and to assess the efficacy of translocating avian predators.

In 2000, the second year of selected avian predator removal was undertaken to examine the effect of avian predators on chick fledging success at specific sites in Monterey Bay. The Santa Cruz Predatory Bird Research Group (SCPBRG) had responsibility for trapping, transporting, and releasing raptors from the Refuge, the Salt Ponds, and Zmudowski State Beach. The second year of the study saw improved protocols and increased funding, contributing to quicker and more efficient predator translocation and an overall increase in effectiveness. In addition, during the second study year, Zmudowski State Beach was included in the experiment based on evidence that shrikes were contributing to the low snowy plover fledge rates documented at this site (14% in 1999). Fledge rates were relatively high at all three Monterey Bay area study sites in 2000. At the Refuge, where three female harriers were translocated, the fledge rate increased from a 1997-1999 average of 14% to a value of 28% in 2000. A male harrier remained at the Refuge the entire season and could not be trapped, but removal of the females prevented harrier nesting and the consequent increase in food demands. For the season, we had 7 of 8 targeted harriers caught (3 trapped on refuge, 1 trap shy male not caught; 4 on Salt Ponds - 2 early season, 2 late), 3 of 3 targeted shrikes on Zmudowski).

16. Marking and Banding

All snowy plovers on the Refuge are banded by PRBO. Unique color leg band combinations are used to be able to distinguish each individual.

H. PUBLIC USE

1. General

Most of the Refuge is closed to public use in an effort to protect rare and endangered species. The Refuge is used primarily for surf fishing, waterfowl hunting and nonconsumptive use, such as wildlife viewing, hiking and photography.

8. Hunting

Waterfowl hunting is allowed on the Refuge during the waterfowl hunting season, usually October through January.

9. Fishing

Surf fishing is allowed year-round on the lands adjacent to the Refuge. No fishing is allowed in the Salinas River.

16. Other Non-wildlife Oriented Recreation

Horseback riding and dog walking are prohibited on the Refuge although they do occur..

17. Law Enforcement

On Sunday October 15th, Officer Barry Tarbet observed two hunters hunting under power in the Salinas River. The hunters were contacted, cited and their weapons were seized. To hunt under power is to be in a boat that is under mechanical power (i.e., engine on or the boat accelerates quickly and the engine is turned off, gliding into a raft of birds).



On November 10th, Officer Barry Tarbet drove through the Refuge parking lot and noted that someone had dumped a washer and dryer in the South-East corner of the lot. The lot was also vandalized by means of 4x4 vehicle traffic cutting "donuts" in the mud and throwing mud on the Refuge signs making them illegible.

Refuge parking lot after 4x4 spinning.



Refuge parking lot signs after 4x4 spinning.

I. EQUIPMENT AND FACILITIES

5. Communications Systems

The Refuge has no telephone available for public use.

J. OTHER ITEMS

2. Items of Interest

On December 19th, Dave Paullin, the CA/NV Refuge Supervisor, toured Ellicott Slough and Salinas River.

3. Credits

Author: Refuge Manager Ivette Loredó

Reviewers: Refuge Complex Manager Marge Kolar
Deputy Project Leader Mike Parker

**MARIN ISLANDS NATIONAL WILDLIFE REFUGE
AND STATE ECOLOGICAL RESERVE**

Marin County, California

ANNUAL NARRATIVE

Calendar Year 2000

U.S. Department of the Interior
Fish and Wildlife Service

NATIONAL WILDLIFE REFUGE SYSTEM

INTRODUCTION

The Marin Islands National Wildlife Refuge (NWR) and State Ecological Reserve (SER) is one of seven National Wildlife Refuges included as part of the San Francisco Bay NWR Complex. The San Francisco Bay NWR Complex manages natural resources (fish, wildlife, plants) in the largely urban setting (in proximity to San Francisco, Oakland, San Jose, Fremont, Vallejo) where nearly 8 million people live in competition to the natural world. The Marin Islands NWR is located east of San Rafael in Marin County.

Marin Islands NWR was established as the 479th NWR in April, 1992, and is managed as a joint National Wildlife Refuge and State Ecological Reserve (SER). The islands and tidelands were acquired cooperatively by the Fish and Wildlife Service, California Department of Fish and Game, State Lands Commission, Marin County Open Space District, Marin Conservation League and Trust for Public Lands. The California Department of Fish and Game (CDFG) owns West Marin Island (2.8 acres), and the State Lands Commission owns the western portion of East Marin Island. The FWS provides oversight, management and implements conservation measures for the two islands and adjacent tidelands under a memorandum of agreement with all partners who helped establish this refuge.

To date, no permanent staff have been solely dedicated to oversee the Marin Islands NWR/SE. Instead, permanent staff responsible for the San Pablo Bay NWR have provided ancillary management of the day-to-day operations of Marin Islands NWR. The Marin Islands NWR/SER includes two islands totalling 13 acres and an additional 325 acres of tidelands (tidally influenced; mudflat/open water) located immediately surrounding the two islands. The management focus has been annual monitoring of the Ciconiiforms and Allies on the 2.8 acre West Marin Island, and habitat management and restoration planning for the 10.3 acre East Marin Island.

Decisions on the future status of the former residence quarters (main house; guest house) on East Marin Islands will be made during the Comprehensive Conservation Plan process. Additional habitat restoration and enhancement of the East Marin island is needed for propagation of native plants, including Buckeye, one of several plant species that will provide habitat requirements consistent with and favorable to the Ciconiiformes nesting on the adjacent West Marin Island. Habitat improvements on East Marin Island could result in the expansion of the Ciconiiform heronry onto the larger East Marin Island. The exact factors that have discouraged herons, egrets, gulls, and ravens from expanding onto and colonizing the larger East Marin Island are still unknown. San Pablo Bay NWR staff suggested the extreme differences in vegetation composition between the two islands--unavailability of nesting habitat, exotic tree dominants, and the unknown degree of disturbance over the previous 100+ years on East Marin Island all possibly impact recolonization and bird use on this larger island.

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A. HIGHLIGHTS

The highlights for the Marin Islands NWR/SER in calendar year 2000 included the continued monitoring of one of the largest heron and egret colonies in northern California on West Marin Island by Audubon Canyon Ranch lead researcher John Kelly. Funding from Regional Office contaminants branch to investigate the status of asbestos tiles from the main house and ceiling tiles from the guest house on East Marin Island (Ninyo and Moore contract; Tim Bodkin), and the initiation of the MMS Project Boat Dock and Stairway Replacement Project, led by Regional Engineer Rob Ochs (contracted by Vortek Diving) and initiated by former Deputy Project Leader, Marc Webber; and ongoing discussions with Refuge Manager, Bryan Winton about long-term restoration and management needs for the Refuge.

While the Marin Islands NWR/SER receives a lower level of staff involvement and protection than staffed refuges in the NWRS, a significant maintenance-type project was funded using Flood Funds appropriated from a previous El Nino year beginning in October 2000. The boat dock and stairway replacement project was funded at \$251,832.00 which will result in the complete removal of the unsafe and deteriorated boat dock, stairway and creosote pilings, reduction of the boat dock and stairway footprint, and installation of an environmentally friendly series of pilings with smaller boat landing dock. This Project represents the largest funding allocation for management, conservation, and improvements for this unit of the NWRS, since the original purchase of the Marin Islands NWR/SER nearly 10 years ago.

B. CLIMATE CONDITIONS

See Appendix or the following internet address for climatological information in 2000:
<http://lwf.ncdc.noaa.gov/servlets/ACS>

C. LAND ACQUISITION

No lands were added to the Marin Islands NWR/SER in Calendar Year 2000. The current acreage of the Marin Islands NWR/SER is 411.88 acres. See the maps section in this document.

D. PLANNING

1. Master Plan

Initial management planning was prepared by Complex Refuge Manager, Richard Coleman. A conceptual Master Plan was initiated but will be completed as part of the Comprehensive Conservation Planning (CCP) effort initiated in fiscal year 2002, with support from the Regional Office refuge planning staff.

2. Management Plan

The U.S. Fish and Wildlife Service (Service) committed to establishment of a Management Plan for the Marin Islands NWR in 1992, to be completed within 2 years of refuge/SER establishment. Because the Marin Islands NWR/SER has been an unstaffed refuge since establishment, the Management Plan has not yet been completed. San Pablo Bay NWR manager, Bryan Winton and Wildlife Biologist, Louise Vicencio organized all Marin Islands NWR files and sorted materials needed for establishment of the Management Plan.

Requests were made in 2000 to identify Marin Islands NWR/SER as a priority station for completion of the Comprehensive Conservation Plan (CCP) which will include all information found in a Management Plan.

The importance in completing the Management Plan and/or CCP is critical. Before existing habitat and structures can be removed, complete support must be obtained from founding supporters and land management agencies (Service and CDFG). In the mean time, the existing habitat (primarily exotic *Eucalyptus* spp., Monterey pine and Scotch broom) literally dominate the composition of vegetation on East Marin Island. This plant community has offered very little value to wildlife since establishment of the Refuge. Loss of a human presence and a reduced disturbance regime have not been sufficient to attract or expand the adjacent egret and heron colony. Future management planning (CCP) will address habitat restoration needs to improve conditions for native plants and wildlife. Please see the Existing Management Plans section of this document.

4. Compliance with Environmental Mandates

Environmental Compliance support was received by Dan Forney, Tom O'Brien, Tom Smiley and Anan Raymond in the Regional Office Contaminants Division in late 2000. Investigation of asbestos-containing materials in the two residences located atop East Marin Island was investigated by contractor, Ninyo and Moore Geotechnical and Environmental Sciences Consultants, 675 Hegenberger Road, Suite 220, Oakland, California 94621. Their report entitled, "Limited Asbestos Survey San Pablo Bay National Wildlife Refuge, Marin Islands, Marin County, California" was prepared and provided on December 29, 2000 (Project No. 400385-01). This report can be obtained from the main files at San Pablo Bay NWR, headquarters on Mare Island. Follow-up abatement is scheduled for August 2001 which will include removal of 9" floor tiles in the main house and wall accoustic in the guest house.

Thanks to Dan Forney and all Contaminants Division staff for end-of-year funding to prepare the houses on East Marin Island for eventual removal or renovation. Bryan Winton, Refuge Manager and Wildlife Biologist, Louise Vicencio, in 2000, recommend complete removal of structures and exotic vegetation, in large part, completely rehabilitating the vegetation and habitat composition of East Marin Island. Plans as such are currently underway.

5. Research and Investigations

John Kelly with Audubon Canyon Ranch, Stinson Beach, California is the lead researcher for the Marin Islands NWR/SER in 2000. John has conducted and evaluated egret and heronry research in the San Francisco Bay since 1979 and has been the sole researcher involved with the refuge/state ecological reserve since establishment, except for Barbara Salzman, who helped monitor the colony in Spring 1992 and 1993.

A Summary of Special Use Permits issued for biological monitoring is included below:

John Kelly, Audubon Canyon Ranch (Heronry census): 1994-2000.

Barbara Salzman, Marin Audubon Society (Heron count): 1992-1993.

Robert Ornduff, University Professor: Vegetation inventory - 1993.

Doris Sloan, University Professor: Geology/Book - 1993.

William Likicker, University Professor: Mammalogy - 1992.

Please see the Biological Monitoring section of this document which includes a table format of avian monitoring since 1979.

E. ADMINISTRATION

1. Personnel

Personnel responsible for management and oversight of the Marin Islands NWR/SER in 2000 included Refuge Complex Manager, Marge Kolar, Deputy Manager Marc Webber, San Pablo Bay and Marin Islands NWR's manager Bryan Winton and Wildlife Biologist, Louise Vicencio.

5. Funding

Operational funding for this refuge is part of the San Francisco Bay NWR Complex budget.

6. Safety

No safety violations were experienced on Marin Islands NWR/SER in 2000.

7. Technical Assistance

Rob Ochs, Regional Office Engineer (boat dock and stairway replacement project) and Dan Forney, Regional Office Contaminants Division (residences asbestos abatement project) provided

supervisory technical assistance for the Marin Islands NWR/SER in 2000.

F. HABITAT MANAGEMENT

1. General

Minimal habitat management was conducted on the Marin Islands NWR/SER in 2000. Refuge Manager, Bryan Winton conducted Scotch Broom (invasive nuisance understory vegetation) removal in an area not to exceed 1000 square feet in an area north of the guest house on the east end of East Marin Island. Inspection of the regrowth in May 2001 revealed the removal project was very successful.

2. Wetlands

A tidally influenced lagoon (appx 0.4 acres) 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 Palm Trees, similar to those located near Building 505 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. (overstory), and Coast Live Oak (mid-story). This forest has been in a degrading state since removal of the Barbary Coast sheep before acquisition in April, 1992. Since establishment of the Marin Islands NWR, the sheep have been removed and the vegetation unmaintained. Eucalyptus and Monterrey Pine leaf litter acts as an allelopathic agent suppressing regeneration of Coast Live Oak, Buckeye, and other desirable native species.

Future management of East Marin Island should include an extensive harvest of overstory trees, reintroduction of a manageable population of goats or sheep, and a prescribed fire that would remove the foot-deep pine needle top litter layer. Any two of these three recommendations would ultimately benefit the long-term value of the East Marin Island to native, resident, and migratory wildlife.

6. Other Habitats

West Marin Island supports the largest egret and heron rookery in northern California. The attractiveness of West Marin Island is due to the abundance of low-growing (10-15') native vegetation, primarily Buckeye. Egrets and Herons opt to return to West Marin Island in increasing abundance annually, while little or not use of East Marin Island has been observed. In 1999, John Kelly with Audubon Canyon Ranch observed a few Great Blue Heron nests in the tops of Eucalyptus trees on East Marin Island. However, they have not returned or been observed in the past two seasons.

11. Water Rights

East Marin Island is fed via a pipeline from San Pedro Drive near Loch Lomond Harbor (Beach and Marine Drive) that provides City of San Rafael water to the island. The water to the island was not activated in 2000. Any future freshwater management for wildlife or necessary water source for grazing livestock should include long-term maintenance of the water line to the island. An April 24, 1992 VCR video made by Jon Adamson, LE Officer, Mike Parker, Wildlife Biologist, and Doug Roster, Refuge Manager for the San Francisco Bay NWR Complex describes perfectly the protocol for turning on and maintaining the water line and electricity issues for East Marin Island. Video is located in Marin Islands main files.

The utilities on East Marin Island are still viable although, for the most part, have gone virtually unused in the past several years. Requests by PGE for a monthly electrical meter reading still occur and the water to the islands was not activated in 2000. Therefore, it is uncertain if the pipeline to the island is still functioning without leaks. Landowner, Colin McCray at 35 Marine Drive (415) 243-4655 owns the house adjacent to the Marin Islands NWR water meter. He cleared the old fence and ivy from in front of his house and requested in May 2001 that the meter box, which stands 2 feet above-ground, be retrofitted to blend in better, add safety, and improve the appearance of his front yard. He now knows that he should have left the ivy and fence there (for better meter concealment). Mr. McCray has requested that FWS pursue have the meter removed or retrofitted. Due to uncertainty of habitat restoration efforts on the East Marin Island in the future, FWS will not be removing or de-activating the water meter at this time.

G. WILDLIFE

1. Wildlife Diversity

The wildlife diversity in the Marin Islands NWR has been documented. Mammals are generally not present on the islands except for an occasional harbor seal. Bat use has been undetermined but small mammal, rodent, furbearer, amphibian, and reptile populations are rare to non-existent.

The value of the Marin Islands NWR/SER is optimal for migratory, resident and nesting birds. The species found nesting on the West Marin Island include Great Egret, Snowy Egret, Great Blue Heron, Black-Crowned Night Heron, Common Raven and Western Gulls. Black Oystercatcher, Surf Scoter, Osprey, and migratory small passerines were observed in 2000. Canada Geese were observed nesting on East Marin Island in 2000. Other common shorebirds and waterfowl found throughout the Bay during winter migration also utilize tidelands adjacent to the Marin Islands NWR/SER. See the Appendices for a report on the relative occurrence and species abundance over the past 22 years.

2. Endangered and/or Threatened Species

No Endangered and/or Threatened Species are known to utilize the Marin Islands NWR. Migratory non-game bird use studies have not been conducted to evaluate the value of the Marin Islands NWR/SER to those species. Additional research to explore use by T&E species is needed.

3. Waterfowl

Surf Scoter, Canvasback, and Scaup are waterfowl species most prevalent using the adjacent tidelands included as part of the Marin Islands NWR/SER. Further studies are needed to document the full range of waterfowl species, and their relative occurrence and abundance, found using the Marin Islands NWR/SER.

4. Marsh and Water Birds

Great egrets, Snowy egrets, Great blue herons, and Black-crowned night herons nest on West Marin Island and infrequently use East Marin Island for perching, feeding, or resting habitat. The majority of water bird use for the refuge occurs during the nesting season (April-August annually) on West Marin Island. Adjacent and included tidelands provide wading habitat for egrets and herons during low tide.

5. Shorebirds, Gulls, Terns, and Allied Species

Black Oystercatcher and other marine birds visit the Marin Islands NWR/SER during low tides when several exposed spits are available due to previous dredging activities. The most prominent "jetty" lies between West and East Marin Island and fronting the boat dock on East Marin Island.

California gulls, Canada Geese, Cormorants and Ravens are common birds that may nest on the Marin Islands NWR/SER.

6. Raptors

Few raptors were observed on East Marin Island in 2000. Osprey were observed on East Marin Island perched atop Eucalyptus trees with fish in talon in 2000.

9. Marine Mammals

Harbor seals have historically been known to haul out on the West Marin Island. No Harbor seals were observed ashore the Marin Islands NWR/SER during low tide in 2000.

10. Other Resident Wildlife

Currently, due to previous dwellings and an intensive landscape regime, very few birds (particularly egrets/herons) have taken to the East Marin Island. Future management will focus on improving vegetation structure to attract resident wildlife and provide nesting cover for natives.

11. Fisheries Resources

The Refuge's tidelands lie in the migratory pathway of anadromous fish moving from the Sacramento-San Joaquin River systems to the Pacific Ocean. Steelhead Salmon and Winter-run Chinook are fish species identified as most threatened and are likely to use these tidelands.

16. Marking and Banding

John Kelly, Audubon Canyon Ranch requested permission to access West Marin Island to trap Ravens for a radio-telemetry investigation. No Ravens were caught, but observations of Raven activity in 2000 included sightings of Ravens killing adult Snowy Egrets on numerous occasions. Initial impacts were assumed to include Raven predation on eggs and young. These observations confirmed that Ravens are probably not only taking eggs and young. Otherwise, no scientific collections from Marin Islands NWR/SER in 2000.

H. PUBLIC USE

1. General

The Marin Islands NWR/SER is closed to the general public under current management. Access onto the islands is by Special Use Permit only at this time. The Comprehensive Conservation Planning for the refuge will be initiated in Fiscal Year 2002. During this process, the public use opportunities will be evaluated and be subjected to public scrutiny. The compatibility of public use opportunities found appropriate will be evaluated and the final product will guide refuge management for the next 10-15 years.

9. Fishing

Commercial fishing is permitted in State water adjacent to the Marin Islands NWR/SER. Fishing effort and catch are not known for areas surrounding the Marin Islands NWR/SER.

11. Wildlife Observation

Future opportunities for wildlife observation to promote the Marin Islands NWR/SER would be an appropriate, compatible public use activity. Commercialization of this wildlife spectacle during the nesting season would produce a viable income for an environmentally sensitive business located in the San Rafael area. A Boating tour to view wildlife would be one possible attraction.

16. Other Non-Wildlife Oriented Recreation

Jet skis and sea kayaks are small craft that have been observed in dangerously close proximity to the nesting egrets and herons on West Marin Island. These craft are not wildlife-dependent but would be appropriate for public access if an educational buoy system were installed to prevent public watercraft from accessing too close to the sensitive nesting birds, particularly the north side of West Marin Island.

17. Law Enforcement

Law Enforcement patrols on Marin Islands NWR/SER are conducted monthly by San Francisco Bay NWR Complex officers, Barry Tarbet, Jon Anderson, and Don Edwards San Francisco Bay NWR manager, Clyde Morris in 2000.

I. EQUIPMENT AND FACILITIES

1. New Construction

The boat dock and stairway replacement was initiated in 2000. This Project represented the first major financial commitment to the refuge since its establishment in 1992, to improve upon the existing condition of the facilities acquired as part of the refuge. This project was funded from Flood Funds for to repair damages incurred during previous El Nino storms. The boat dock pilings, boat dock, gangway, stairs, and storage shed will all be removed in early 2001 to permit the installation of new environmentally-friendly piling system, and a boat dock and stairs considerably smaller in size than the inherited design. The replacement of the boat dock will allow continued access onto East Marin Island for many years into the future to continue avian research, and to prepare for future rehabilitation of the island (i.e., vegetation removal, native replantings, building removal, etc.).

3. Major maintenance

Major maintenance of the health and safety of the existing facilities and structures on the East Marin Island included asbestos survey. In preparation of future removal and/or renovation of the guest house and main house on East Marin Island, asbestos surveys were conducted to identify hazards so that future demolition/renovation can progress without surprise health concerns.

4. Equipment Utilization and Replacement

The 13' Boston whaler dedicated for accessing the Marin Islands NWR/SER was not identified for replacement in the 5-year plan produced in 2000. The small whaler, while adequate for 1-2 staff, is insufficient for adequately and safely transporting 4-6 people as is often preferable.

J. OTHER ITEMS

2. Items of Interest

Professional photographer David Sanger accompanied Refuge Manager, Bryan Winton on October 26, 2000 to take photographs to be included in a San Francisco Bay Book (see <http://sanfranciscobaybook.com>). David Sanger (david@davidsanger.com) attended the 5th Annual Northern San Francisco Bay Flyway Festival on Mare Island and provided visuals of the final product. Copies of his final product have been requested.

3. Credits

Bryan Winton prepared this narrative.

The following staff and supporters deserve recognition for the content of the annual narrative.

Richard Coleman, Refuge Complex Manager at the time of acquisition for pursuing the addition to the National Wildlife Refuge System. Betsy C. Radtke and Doug Roster, for initial planning, support, and management of the island refuge. Jon Adamson, LE Officer for the Complex, Mike Parker, Wildlife Biologist, and Doug Roster for participation and creating of a video that outlines all the necessary protocol for activation and maintenance of the water and electrical system for the East Marin Island. This video has been found to be valuable to Bryan Winton, Refuge Manager, on several occasions in 2000. This video was made in 1992 during the time of acquisition. The video documents pre-acquisition conditions which will prove beneficial in perpetuity. Thanks to Chuck Morton, Caltrans for aerial photography and remote sensing photos, to John Takekawa, USGS, San Francisco Estuary Field Station, and staff Greg Martinelli for assistance with the asbestos survey site-visit. Louise A. Vicencio, Wildlife Biologist for the Marin Islands and San Pablo Bay NWR's is credited for contributing in many ways: biologically, management issues, and future vision for long-term strategy wildlife conservation for this refuge.

K. APPENDICES

1. Climatological Conditions for 2000.
2. Special Use Permits Summary
3. Maps
4. Photographic Documentation

CLIMATOLOGICAL CONDITIONS for 2000

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

ANNUAL CLIMATOLOGICAL SUMMARY (2000)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Station: **047880/99999, SAN RAFAEL CIVIC CENTER, California**

Elev. 120 ft. above sea level

Lat. 38°00'N, Lon. 122°32'W

| Date | Temperature (° F) | | | | | | | | | | | | | | Precipitation (inches) | | | | | | | | | | |
|---------------|-------------------|--------------|-------|---------------------------|---------------------------|---------------------------|---------|--------------|--------|-------------|----------------|--------------|--------------|-------------|------------------------|---------------------------|-------------------|------|---------------|--------------|-------------|----------------|-------|-------|--|
| Elem-> | MMXT | MMNT | MNTM | DPNT | HTDD | CLDD | EMXT | | EMNP | | DT90 | DX32 | DT32 | DT00 | TPCP | DPNP | EMXP | | TSNW | MXSD | | DP01 | DP05 | DP10 | |
| 2000 Month | Mean Max. | Mean Min. | Mean | Depart. from Normal | Heating Degree Days | Cooling Degree Days | Highest | High Date | Lowest | Low Date | Number of Days | | | | Total | Depart. from Normal | Greatest Observed | | Snow, Sleet | | | Number of Days | | | |
| | | | | | | | | | | | Max >=90° | Max <=32° | Min <=32° | Min <=0° | | | Day | Date | Total Fall | Max Depth | Max Date | >=.10 | >=.50 | >=1.0 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 56.8 | 44.3 | 50.6 | 1.8 | 439 | 0 | 64 | 5 | 36 | 6 | 0 | 0 | 0 | 0 | 8.13 | 0.24 | 2.11 | 24 | 0.0 | 0 | | 12 | 5 | 2 | |
| 2 | 57.7X | 46.2X | 52.0X | -0.9 | 371B | 0B | 63 | 8 | 37 | 24 | 0 | 0 | 0 | 0 | 12.79 | 6.97 | 2.38 | 13 | 0.0 | 0 | | 15 | 10 | 4 | |
| 3 | 65.1 | 45.2 | 55.2 | 0.6 | 308 | 9 | 80 | 31 | 38 | 24 | 0 | 0 | 0 | 0 | 1.83 | -3.12 | 0.51 | 8 | 0.0 | 0 | | 5 | 1 | 0 | |
| 4 | 68.9X | 48.9X | 58.9X | 1.6 | 190B | 15B | 88 | 2 | 43 | 29 | 0 | 0 | 0 | 0 | 2.41 | 0.45 | 1.07 | 16 | 0.0 | 0 | | 4 | 2 | 1 | |
| 5 | 73.4X | 51.5X | 62.5X | 1.4 | 128B | 60B | 98 | 21 | 43 | 11 | 4 | 0 | 0 | 0 | 1.37 | 1.05 | 0.72 | 13 | 0.0 | 0 | | 2 | 1 | 0 | |
| 6 | 78.3 | 53.7 | 66.0 | 0.6 | 50 | 91 | 107 | 15 | 48 | 4 | 3 | 0 | 0 | 0 | 0.11 | -0.10 | 0.09 | 7 | 0.0 | 0 | | 0 | 0 | 0 | |
| 7 | M | M | M | M | M | M | 83 | 18 | 49 | 3 | 0 | 0 | 0 | 0 | 0.00 | -0.07 | 0.00 | 31 | 0.0 | 0 | | 0 | 0 | 0 | |
| 8 | 80.5X | 54.6X | 67.6X | -0.3 | 20B | 109B | 99 | 1 | 50 | 20 | 5 | 0 | 0 | 0 | 0.00X | M | 0.00 | 31 | 0.0 | 0 | | 0 | 0 | 0 | |
| 9 | 80.3X | 55.4 | 67.9X | 1.0 | 25B | 119B | 102 | 19 | 48 | 10 | 4 | 0 | 0 | 0 | 0.11 | -0.26 | 0.09 | 2 | 0.0X | 0 | | 0 | 0 | 0 | |
| 10 | 69.1 | 49.7 | 59.4 | -3.5 | 167 | 4 | 79 | 1 | 43 | 31 | 0 | 0 | 0 | 0 | 3.39 | 1.24 | 1.70 | 28 | 0.0 | 0 | | 4 | 3 | 1 | |
| 11 | 58.6 | 42.4X | 50.5X | -4.5 | 425B | 0B | 73 | 7 | 32 | 17 | 0 | 0 | 2 | 0 | 1.27 | -4.33 | 0.93 | 29 | 0.0 | 0 | | 2 | 1 | 0 | |
| 12 | 56.8 | 42.1 | 49.5 | 0.4 | 477 | 0 | 64 | 8 | 36 | 30 | 0 | 0 | 0 | 0 | 0.66 | -5.65 | 0.41 | 14 | 0.0 | 0 | | 2 | 0 | 0 | |
| Annual | MX | MX | MX | M | M | M | 107 | Jun | 32 | Nov | 16 | 0 | 2 | 0 | 32.07X | M | 2.38 | Feb | 0.0X | 0 | | 46 | 23 | 8 | |

Notes

(blank) Not reported.

+ Occurred on one or more previous dates during the month. The date in the Date field is the last day of occurrence. Used through December 1983 only.

A Accumulated amount. This value is a total that may include data from a previous month or months or year (for annual value).

B Adjusted Total. Monthly value totals based on proportional available data across the entire month.

E An estimated monthly or annual total.

X Monthly means or totals based on incomplete time series. 1 to 9 days are missing. Annual means or totals include one or more months which had 1 to 9 days that were missing.

M Used to indicate data element missing.

T Trace of precipitation, snowfall, or snowdepth. The precipitation data value will = zero.

Elem- Element Types are included to provide cross-reference for users of > the NCDC CDO System.

Station Station is identified by: CoopID/WBAN, Station Name, State.

S Precipitation amount is continuing to be accumulated. Total will be included in a subsequent monthly or yearly value. Example: Days 1-20 had 1.35 inches of precipitation, then a period of accumulation began. The element TPCP would then be 00135S and the total accumulated amount value appears in a subsequent monthly value. If TPCP = "M" there was no precipitation measured during the month. Flag is set to "S" and the total accumulated amount appears in a subsequent monthly value.

Dynamically generated Mon Jun 03 13:56:03 EDT 2002 via <http://lwf.ncdc.noaa.gov/servlets/ACS>
Data provided from the NCDC CDO System

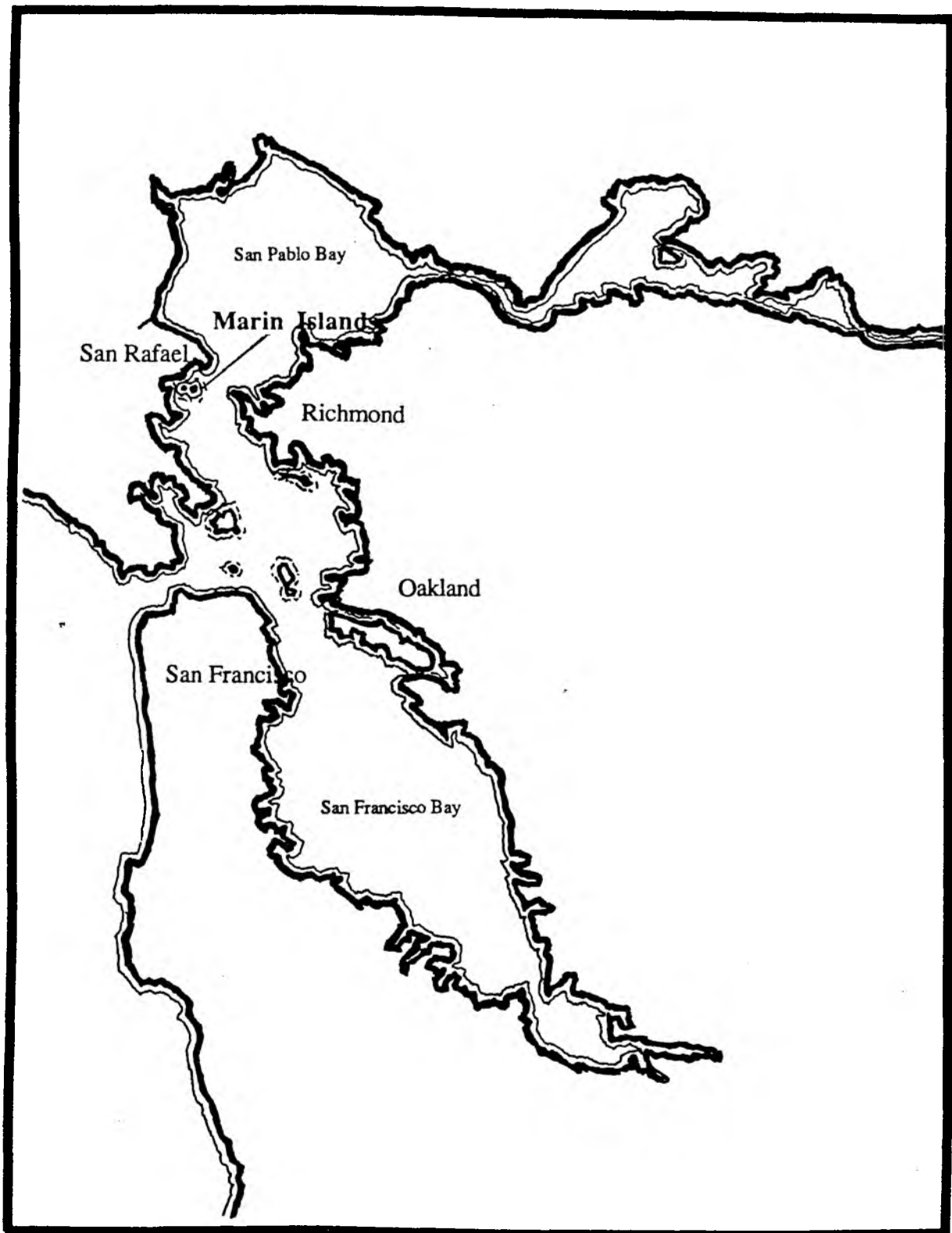
SPECIAL USE PERMIT
SUMMARY

SPECIAL USE PERMIT SUMMARY

This list represents all documented Special Use Permits for public access onto the West and East Marin Islands since the refuge was established in April 1992.

| <u>DATES OF ACTIVITY</u> | <u>PERMITTEE</u> | <u>ACTIVITY</u> |
|--------------------------|--------------------------------|------------------|
| 6-1-92/6-31/92 | Barbara Salzman | Heron Census |
| 8-1-92/1-31-97 | Henry Bowles Pioneer Family | Day trip/visits |
| 8-18-92/9-30-92 | Bill Lidicker | Mammal Research |
| 4-1-93/6-30-93 | John Kelly | Heronry Research |
| 6-1-93/6-3-93 | Robert Ornduff | Plant Inventory |
| 6-1-93/6-30-93 | Barbara Salzman | Heron Census |
| 10-13-93/10-13-93 | Doris Sloan | Book/Geological |
| 4-1-94/6-30-94 | John Kelly | Heronry Research |
| 4-1-95/6-30-95 | John Kelly | Heronry Research |
| 4-1-96/6-30-96 | John Kelly | Heronry Research |
| 3-1-97/6-30-97 | John Kelly | Heronry Research |
| 4-1-98/6-30-98 | John Kelly | Heronry Research |
| 4-1-99/6-30-99 | John Kelly | Heronry Research |
| 4-1-00/6-30-00 | John Kelly | Heronry Research |

MAPS



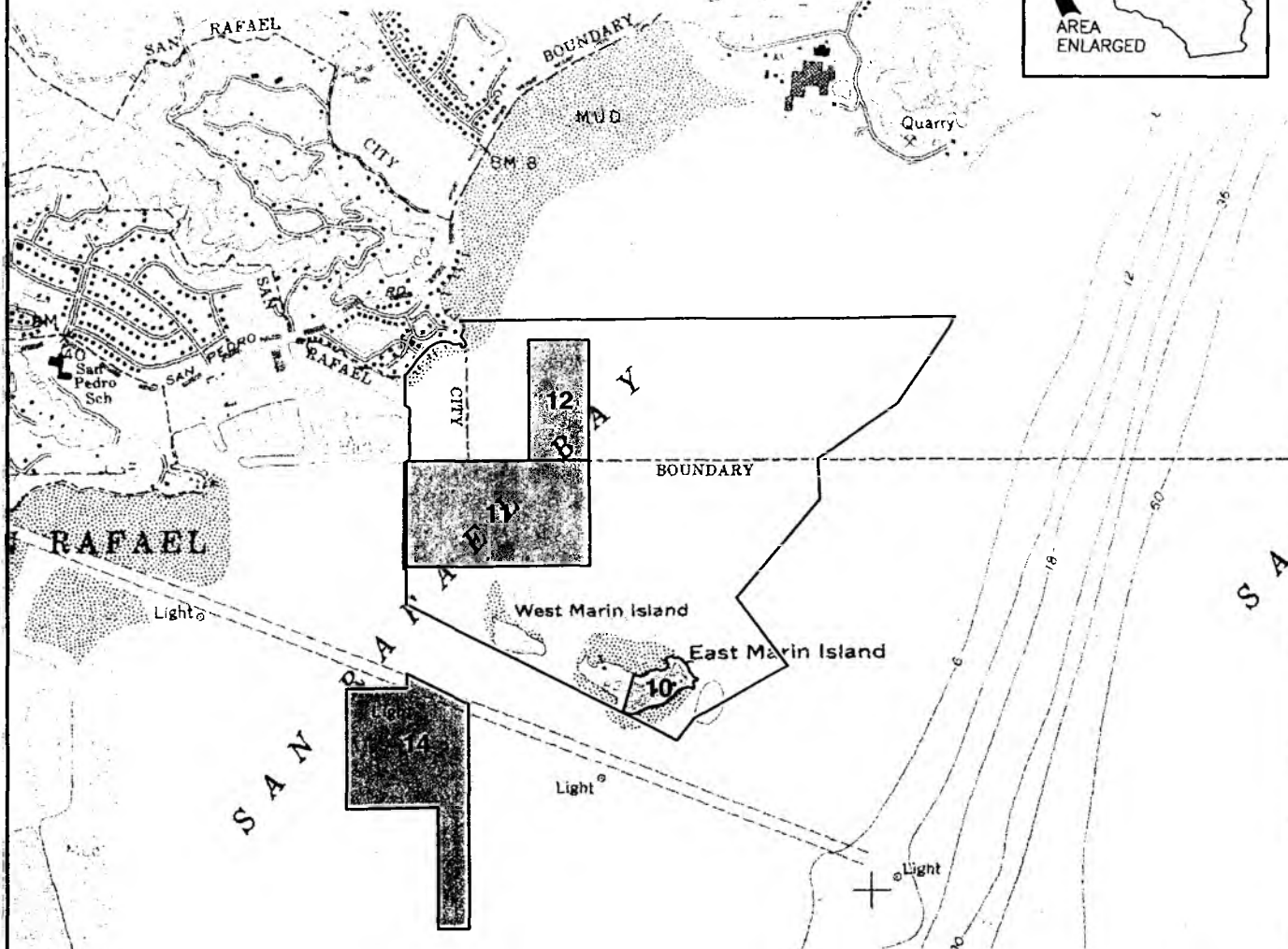
Regional Context

U.S. Fish & Wildlife Service

Marin Islands

National Wildlife Refuge

LAND STATUS



LEGEND

Refuge Lands

- Fee Title
- Approved Refuge Boundary



Branch of GIS & Cartography
R1 Division of Refuge Planning
911 NE 11th Ave.
Portland, OR 97232-4181
503-231-2230

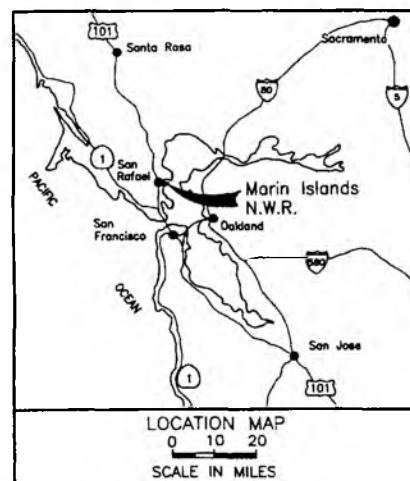


0 500 1,000 2,000 Feet

MAP INFO:

Plot Date: 6-20-01
Map Design: Dave Hoy
Map File: mri_is1.mxd
Boundary Currency Date: 11-7-00

The refuge boundary and land ownership information depicted on this map was compiled from 1:24000 source data. It reflects the current refuge land status according to documents and information available in the U.S. FWS Division of Realty. It may be incomplete and/or contain errors.



PHOTOGRAPHIC DOCUMENTATION



MARIN ISLANDS NATIONAL WILDLIFE
REFUGE - STATE ECOLOGICAL RESERVE

Top photo: Viewing north

Bottom photo: Viewing south





Top photo: West Marin Island

Bottom photo: East Marin Island
-extreme high tide (1990's)





Top photo: West Marin Island

Bottom photo: Left - West Marin
Right - East Marin





Top photo: West Marin Island

Bottom photo: East Marin Island





Viewing the West Marin Island
from East Marin Island
Below: Louise Vicencio refrence





Non-native vegetation on East
Marin Island (includes Scotch
Broom, Fennel, Eucalyptus, Pine)





East Marin Island Boat Dock and
Gangway, Stairs and Storage Shed
Removed (MMS Project) in 2001





Top photo: East Marin Island
"swimming pool" (lagoon). More
non-native Canary Island palm
trees.

Bottom: Miwok shell mound.
Disturbed from prior tenants.
Native American middens are a
cultural, archaeological artifact





Top photo: Main house on East Marin Island. Note wooden ship mast-flagpole; Eucalyptus sprouts

Bottom photo: Guest house on East Marin Island. Note broken deck. Substantial teak-wood construction inside this house.





Storage buildings and water catch
on East Marin Island. Structures
may/may not be maintain. Note
Eucalyptus grove.



Overhead view of East Marin
Island boat dock and walkway
replaced via MMS Project in 2001
Bottom: Louise A. Vicencio, Bio





Replaced boat dock, stairway on
East Marin Island. Vortek Diving
Contract: completed April 2001





Replacement boat dock and
stair way on East Marin Island
Completed April 2001 (pre
installation of reduced boat
dock and gangway





Evidence of boat access/fishing
crossing between East/West Marin
Islands. Potential impact to
nesting Egrets (management issue)