Farallon National Wildlife Refuge
Draft Comprehensive Conservation Plan

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Regional Director, California and Nevada Region

Implementation of this Comprehensive Conservation Plan and alternative management actions/programs have been assessed consistent with the requirements of the National Environmental Policy Act (42 USC 4321 et seq.).

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Chapter 1. Introduction and Background

The Farallon National Wildlife Refuge (Refuge) is located approximately 28 miles west of San Francisco. Totaling 211 acres, it is composed of several islands in four groups: the North Farallons, Middle Farallon, the South Farallon Islands (SFI), and Noonday Rock. The North and Middle Farallons and Noonday Rock were designated as the Farallon Refuge by Teddy Roosevelt in 1909. SFI was given refuge status in 1969 and is the largest of the four groups. Congress designated all these islands except Southeast Farallon Island as the Farallon Wilderness Area in 1974 (Public Law 93-550). The Farallons are also designated as a State Ecological Reserve and a Golden Gate Biosphere Reserve.

The U.S. Fish and Wildlife Service (Service) prepared this Draft Comprehensive Conservation Plan (CCP) to guide refuge management for the next 15 years. The purposes of this CCP are listed below.

- Provide a clear statement of direction for the management of the Refuge during the lifetime of the CCP.
- Provide long-term continuity in Refuge management.
- Communicate the Service's management priorities for the Refuge to its neighbors and the public.
- Provide an opportunity for the public to help shape the future management of the Refuge;
- Ensure that management programs on the Refuge are consistent with the legal and policy mandates for the NWR System (Refuge System) and the purpose of the Refuge as set forth in establishing documentation.
- Ensure that management of the Refuge is, to the extent practicable, consistent with federal, state, and local plans.
- Provide a basis for budget requests to support the Refuge's needs for staffing, operations, maintenance, and capital improvements.
- Evaluate existing and proposed uses on each of the Refuge's to ensure that they are compatible with the Refuge purpose(s); the Refuge System mission; and the maintenance of biological integrity, biodiversity, and environmental health.

Need for this CCP

No formal management plan currently exists for the Refuge. The National Wildlife Refuge System Improvement Act of 1997 (16 United States Code [USC] 668dd-668ee) (1997 Improvement Act) requires that all refuges be managed in accordance with an approved CCP by 2012. Under the 1997 Improvement Act, the Refuge System is to be consistently directed and managed to fulfill the specific purpose(s) for which each refuge was established as well as the Refuge System Mission. The planning process helps the Service achieve the refuge purposes and the Refuge System mission by identifying specific goals, objectives, and strategies to implement on each Refuge.

The U.S. Fish and Wildlife Service and the National Wildlife Refuge System

U.S. Fish and Wildlife Service

The Service is the primary federal agency responsible for conserving, protecting, and enhancing the Nation's fish, wildlife, and plant populations and their habitats for the continuing benefit of the American people. Although the Service shares this responsibility with other federal, tribal, state, local, and private entities, the Service has specific responsibilities for migratory birds, threatened and endangered species, interjurisdictional fish, and certain marine mammals. These are referred to as Federal Trust Species. The Service also manages the Refuge System and National Fish Hatcheries; enforces federal wildlife laws and international treaties related to importing and exporting wildlife; assists state fish and wildlife programs; and helps other countries develop wildlife conservation programs.

The National Wildlife Refuge System

The National Wildlife Refuge System is the world's largest collection of lands specifically managed for fish and wildlife conservation. Unlike other federal lands that are managed under a multiple-use mandate (e.g., National Forests and lands administered by the U.S. Bureau of Land Management [BLM]), the Refuge System is managed primarily for the benefit of fish, wildlife, and plant resources and their habitats. The Refuge System consists of more than 545 units that provide nearly 95 million acres of important habitat for native plants and many species of mammals, birds, and fish, including threatened and endangered species.

National Wildlife Refuge System Mission and Goals

The mission of the NWR System is "to administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans" (1997 Improvement Act).

The goals of the National Wildlife Refuge System are listed below.

a. *Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.*

b. *Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.*

c. *Conserve those ecosystems; plant communities; wetlands of national or international significance; and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.*

d. *Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).*

e. *Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.*

Legal and Policy Guidance

Legal mandates and Service policies govern the Service's planning and management of the NWRS. A list and brief description can be found at the "Division of Congressional and Legislative Affairs, USFWS" Website (http://laws.fws.gov). In addition, the Service had developed draft or final policies to guide NWRS planning and management. These policies can be found at the "NWRS Policies" Website (http://www.fws.gov/refuges/policymakers/nwrpolicies.html). The main sources of legal and policy guidance for the CCP and EA are described below.

National Wildlife Refuge System Improvement Act of 1997

Statutory authority for Service management and associated habitat management planning on units of the NWRS is derived from the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), which was significantly amended by the National Wildlife Refuge System Improvement Act of 1997 (Refuge Improvement Act, 16 U.S.C. 668dd-668ee). Section 4(a)(3) of the Refuge Improvement Act states, "With respect to the National Wildlife System [NWRS], it is the policy of the United States that – (A) each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established…" The Refuge Improvement Act also states that the "…purposes of the refuge and purposes for each refuge mean the purposes specified in or derived from law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit."

The Refuge Administration Act, as amended, clearly establishes wildlife conservation as the core NWRS mission. House Report 105-106, accompanying the Refuge Improvement Act, states "…the fundamental mission of our System is wildlife conservation: "…wildlife and wildlife conservation must come first." In contrast to some other systems of federal lands which are managed on a sustained-yield basis for multiple uses, the NWRS is a primary-use network of lands and waters. First and foremost, refuges are managed for fish, wildlife, plants, and their habitats. In addition, units of the NWRS are legally closed to all public access and use, including economic uses, unless and until they are officially opened through an analytical, public process called the refuge compatibility process. With the exception of refuge management activities which are not economic in nature, all other uses are subservient to the NWRS' primary wildlife management responsibility and they must be determined compatible before being authorized.

The Refuge Improvement Act provides clear standards for management, use, planning, and growth of the NWRS. Its passage followed the promulgation of Executive Order 12996 (April 1996), "Management of Public Uses on National Wildlife Refuges", reflecting the importance of conserving natural resources for the benefit of present and future generations of people. The Refuge Improvement Act recognizes that wildlife-dependent recreational uses including hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible with the mission of the System and purposes of the Refuge, are

legitimate and appropriate public uses of the Refuge System. Section 5 (C) and (D) of the Refuge Improvement Act states "compatible wildlife-dependent recreational uses are the priority general public uses of the Refuge System and shall receive priority consideration in planning and management; and when the Secretary determines that a proposed wildlife-dependent recreational use is a compatible use within a refuge, that activity should be facilitated, subject to such restrictions or regulations as may be necessary, reasonable, and appropriate."

The Refuge Improvement Act also directs the Service to maintain adequate water quantity and quality to fulfill the NWRS mission and refuge purposes, and to acquire, under state law, water rights that are needed for refuge purposes.

Appropriate Use and Compatibility Policy

Lands within the NWRS are different from other multiple use public lands in that they are closed to all visitor uses unless specifically and legally opened. The Improvement Act states ". . . the Secretary shall not initiate or permit a new use of a Refuge or expand, renew, or extend an existing use of a Refuge, unless the Secretary has determined that the use is a compatible use and that the use is not inconsistent with public safety." The Improvement Act also states that ". . . compatible wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, or environmental education and interpretation) are the priority general public uses of the System and shall receive priority consideration in Refuge planning and management."

In accordance with the Improvement Act, the Service has adopted a Compatibility Policy (603 FW 2) that includes guidelines for determining if a use proposed on a national wildlife refuge is compatible with the purposes for which the refuge was established. A compatible use is defined in the policy as a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the NWRS mission or the purposes for which the Refuge was established and contributes to the maintenance of biological integrity, diversity, and environmental health. The Policy also includes procedures for documentation and periodic review of existing refuge uses.

The first step in determining if a use is compatible is to determine if the use is appropriate (called an appropriateness finding). The Service evaluates each use to determine if it is appropriate based on the NWRS mission and refuge purpose(s). If a use is not appropriate, the use is not further considered, and a compatibility determination is not required. If a use is determined to be appropriate, the Service must prepare a compatibility determination. When a determination is made as to whether a proposed use is compatible or not, this determination is provided in writing and is referred to as a compatibility determination.

An opportunity for public review and comment is required for all compatibility determinations. For compatibility determinations prepared concurrently with a CCP or step-down management plan, the opportunity for public review and comment is provided during the public review period for the draft plan and associated NEPA document. This draft CCP contains several draft

compatibility determinations for proposed uses on the Refuge (Appendix J-L). These will be open to public comment with the draft CCP and finalized along with the CCP.

Biological Integrity, Diversity, and Environmental Health Policy

Section 4(a)(4)(B) of the Refuge Improvement Act states, "In administering the System, the Secretary shall…ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans…" This legislative mandate represents an additional directive to be followed while achieving refuge purposes and the NWRS mission. The Act requires the consideration and protection of a broad spectrum of fish, wildlife, plant, and habitat resources found on a refuge. Service policy guiding implementation of this statutory requirement provides a refuge manager with an evaluation process to analyze his/her refuge and recommend the best management direction to prevent further degradation of environmental conditions; and, where appropriate, and in concert with refuge purposes and NWRS mission, to restore lost or severely degraded resource components. Within the Biological Integrity, Diversity, and Environmental Health Policy (601 FW 3[3.7B]), the relationships among biological integrity, diversity, and environmental health; NWRS mission; and refuge purposes are explained as follows, "…each refuge will be managed to fulfill refuge purpose(s) as well as to help fulfill the System mission, and we will accomplish these purpose(s) and our mission by ensuring that the biological integrity, diversity, and environmental health of each refuge are maintained and where appropriate, restored."

When evaluating the appropriate management direction for refuges, Refuge Managers will use sound professional judgment to determine their refuge's contribution to biological integrity, diversity, and environmental health at multiple landscape scales. Sound professional judgment incorporates field experience, an understanding of the refuge's role within an ecosystem, and the knowledge of refuge resources, applicable laws and best available science, including consultation with resource experts both inside and outside of the Service.

The priority visitor uses of the NWRS are not in conflict with this policy when they have been determined to be compatible. The directives of this policy do not envision or necessitate the exclusion of visitors or the elimination of visitor use structures from refuges; however, maintenance and/or restoration of biological integrity, diversity, and environmental health may require spatial or temporal zoning of visitor use programs and associated infrastructures. General success in maintaining or restoring biological integrity, diversity, and environmental health will produce higher quality opportunities for providing wildlife-dependent recreational uses.

Draft Wilderness Stewardship Policy Pursuant to the Wilderness Act of 1964

This policy updates guidance on administrative and public activities on wilderness and proposed wilderness within the NWRS. The purpose of the policy is to prescribe how the Service: "preserves the character and qualities of designated wilderness while managing for the refuge establishing purpose(s), maintains outstanding opportunities for solitude and primitive and unconfined type of recreation, and conducts minimum requirements analyses before taking any action that may impact wilderness character."

The policy emphasizes recreational uses that are compatible and wilderness-dependent. The policy clarifies conditions upon which generally prohibited uses (motor vehicles, motorized equipment, mechanical transport, structures, and installations) may be necessary for wilderness protection. It confirms that:

"we will generally not modify habitat, species population levels, or natural ecological processes in refuge wilderness unless doing so maintains or restores ecological integrity that has been degraded by human influence or is necessary to protect or recover threatened or endangered species."

National Environmental Policy Act of 1969

This Draft CCP and associated National Environmental Policy Act (NEPA) document has been prepared consistent with the requirements of NEPA, the Council on Environmental Quality (CEQ) NEPA regulations (40 CFR Secs. 1500 et seq.), and the Department of Interior's NEPA procedures (Department Manual, Part 516). The purpose of the NEPA document (Appendix D) is to evaluate the environmental effects of the CCP on the quality of the human environment.

The CCP is also accompanied by a step-down Weed Management Plan (Appendix N). A wilderness plan was developed in 1978 but has not been updated. A preliminary house mouse eradication proposal was also developed, but further analysis is needed prior to moving forward with this action.

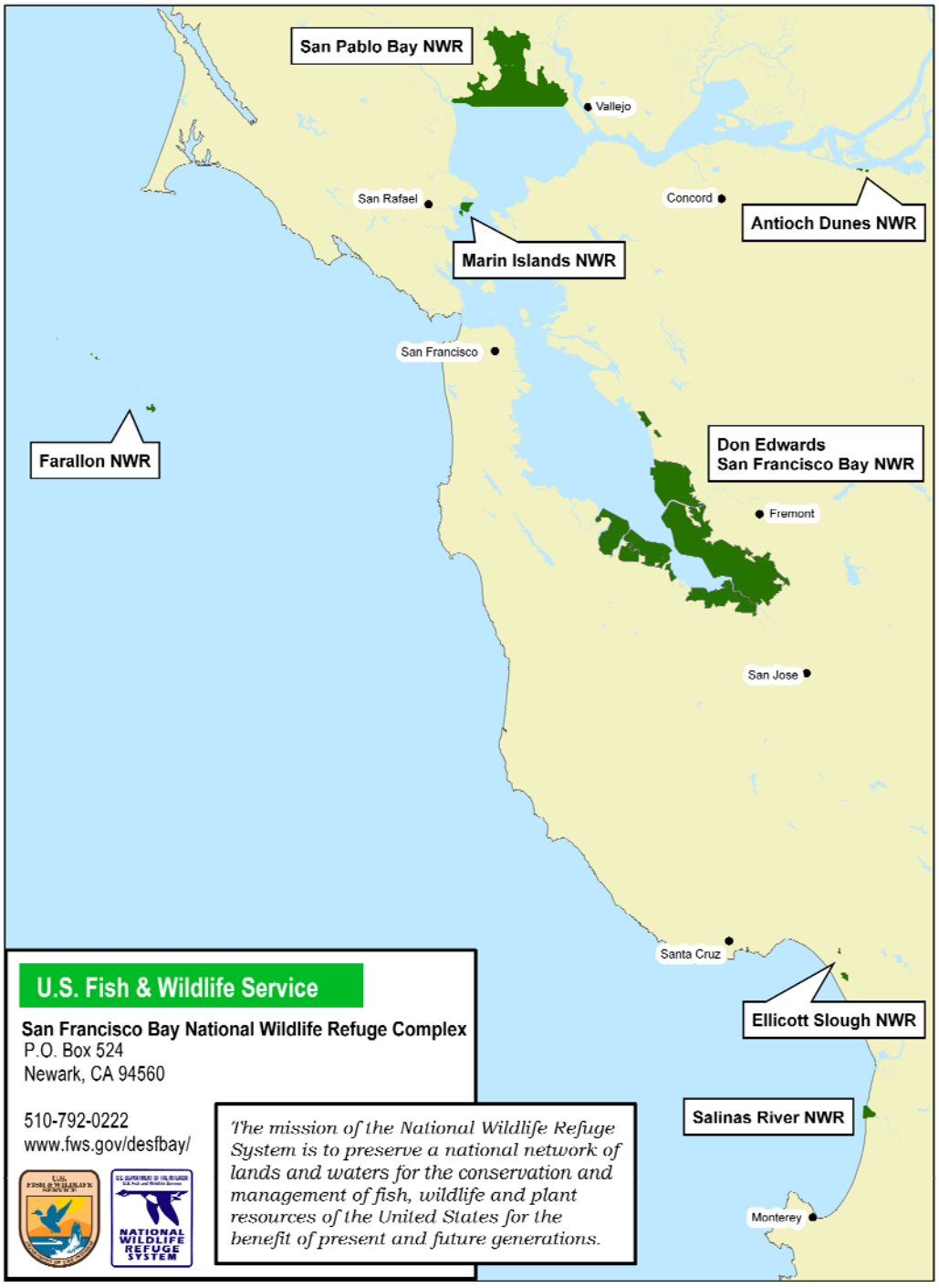
San Francisco Bay National Wildlife Refuge Complex

The San Francisco Bay area has had a significant human presence for thousands of years. A number of Native American tribes including the earliest residents, the Ohlone, have inhabited the area. Later, Spanish settlers immigrated to the area in the late 1700s. The years following the California gold rush in 1849 caused explosive growth and development that placed greater demands on the sensitive lands surrounding the Bay. For example, the salt industry converted tens of thousands of acres of salt marsh into commercial salt ponds.

Conversion of wetlands for developed uses continued well into the twentieth century; today, nearly 85 percent of the Bay's original marshes and shorelines have been altered. With the support of citizens and public officials, seven refuges have been established in the San Francisco Bay Area: Farallon NWR (1909), Salinas River NWR (1973), San Pablo Bay NWR (1974), San Francisco Bay NWR (1974), Ellicott NWR (1975), Antioch Dunes NWR (1980), and Marin Islands NWR (1992). These seven refuges, stretching from Monterey Bay to the Sacramento–San Joaquin River Delta, were combined to create the Refuge Complex (Figure 1). These refuges provide a variety of critical nesting habitat, traditional feeding grounds, and resting areas for Pacific shorebirds, waterfowl, species of concern, and endangered species. Unlike refuges in remote locations, each of these seven refuges shares the task of implementing wildlife

conservation objectives while addressing human needs in a highly urbanized environment. Representative Don Edwards worked with Congress to approve the purchase of lands for the San Francisco Bay NWR, which was officially established in 1974 (Public Law 92-330). This refuge was officially renamed Don Edwards San Francisco Bay NWR in 1995 and serves as the Complex's headquarters.

Figure 1. San Francisco Bay NWR Complex Map



The Farallon National Wildlife Refuge

Location

The Refuge is remote, but just off the coast of San Francisco, California, which is 28 miles east of the Refuge. The Refuge comprises four island groups located within the boundaries of San Francisco City and County (Figure 2). These groups are Noonday Rock, the North Farallons, Middle Farallon, and SFI. SFI consists of West End, Southeast (SEFI) Island, and adjacent outcrops and islets (Figure 3). SFI, the largest of the four groups, is the closest island to the mainland. Middle Farallon, 2 miles northwest of SEFI, is a single rock 50 yards in diameter and 20 feet high. The North Farallons, 4 miles north of Middle Farallon, consist of two clusters of bare, precipitous islets and rocks reaching 155 feet above sea level. Noonday Rock is 3.5 miles northwest of North Farallon. It is submerged even at low tide, but the waters around it are rich in marine life.

Figure 2. Refuge Units Map

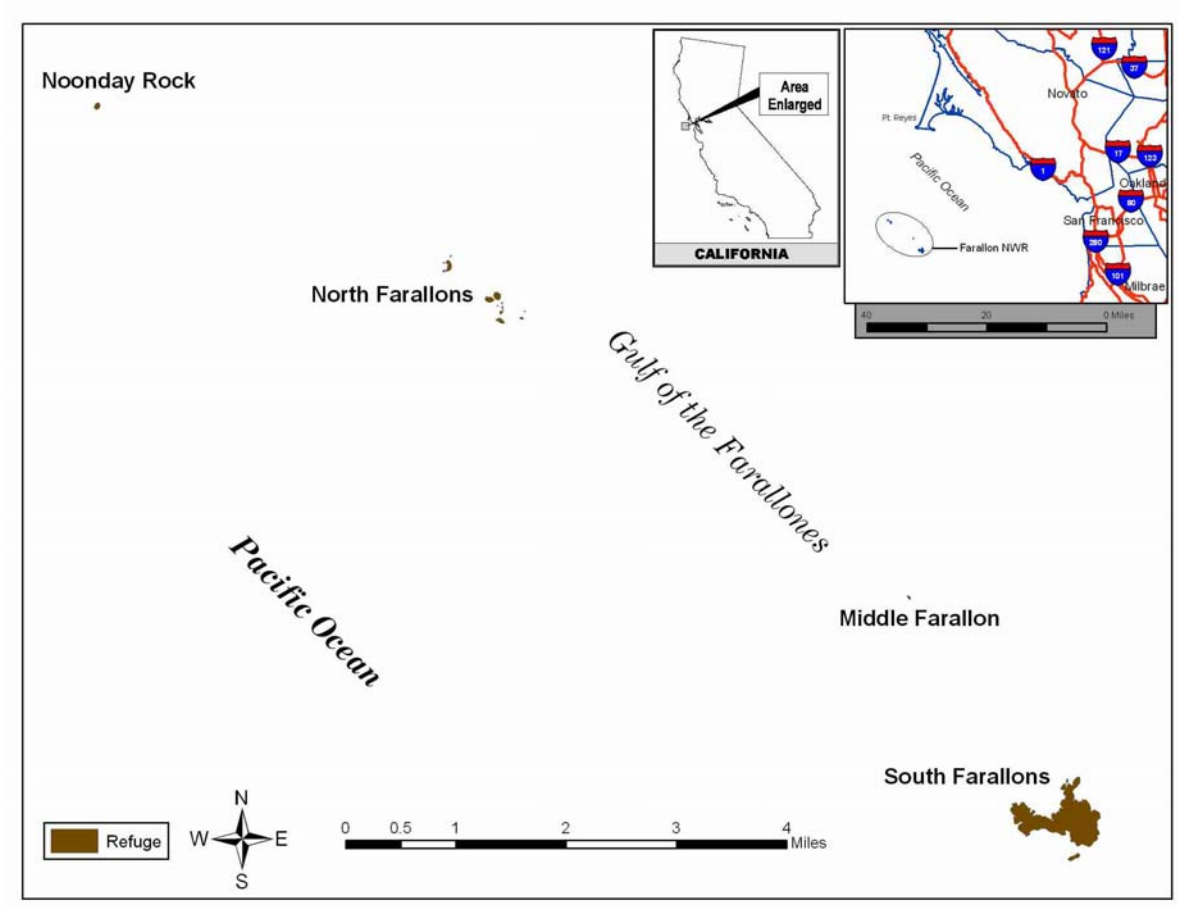
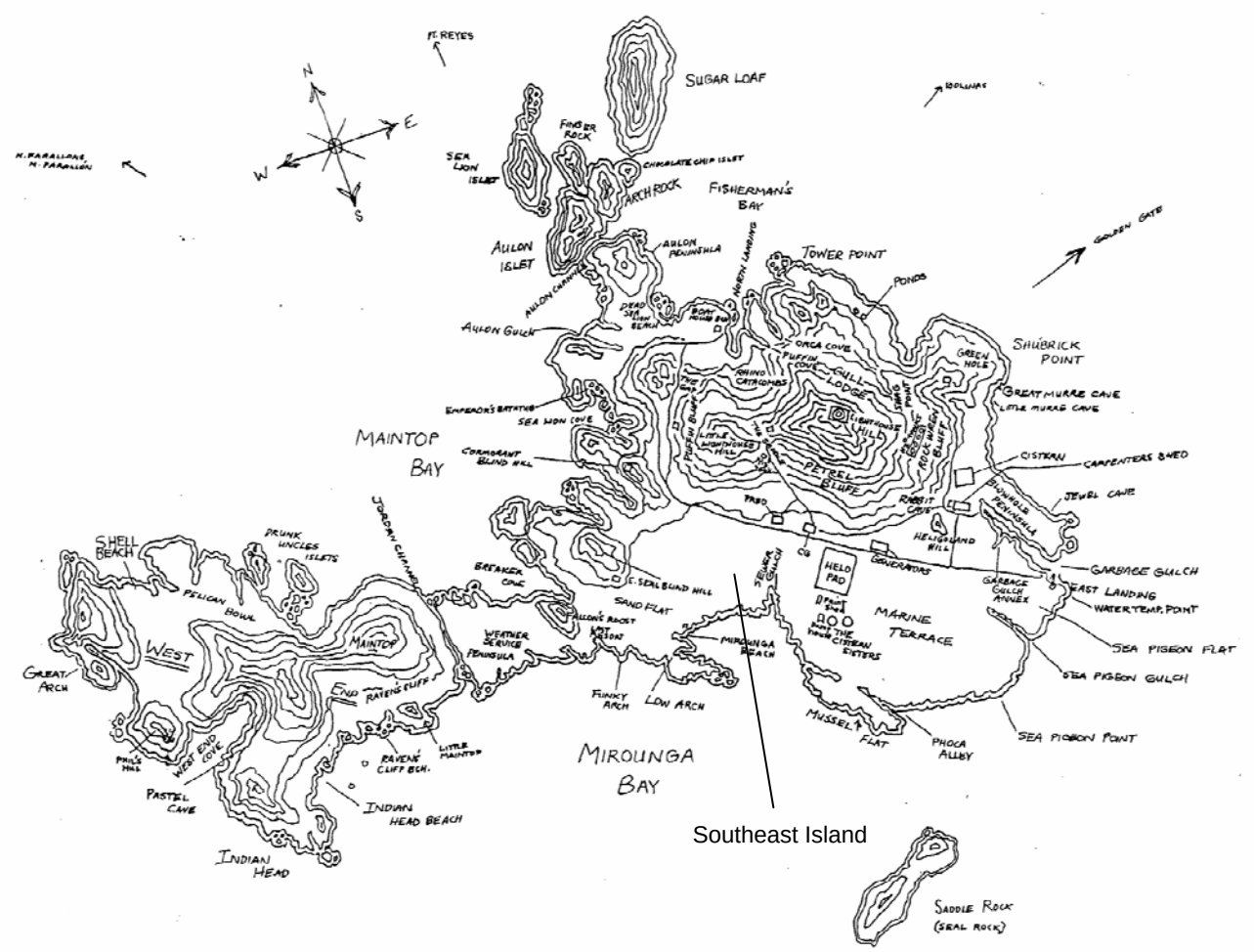


Figure 3. South Farallon Islands



Historical Background

The Spanish named the Farallon Islands in the 1600s. The term *Farallon* means "cliff" or "small island in the sea" (Schoenherr 1999). The first known visitor to the islands was Juan Rodriquez Cabrillo, who sailed along the California coast in 1539 (USDOI 1970). Later, Sir Francis Drake is speculated to have anchored off the islands to replenish his food supply with seals and birds. In the late eighteenth and nineteenth centuries, Americans and Russians exploited the sea lions, fur seals, and sea otters, found in abundance on the islands, for their pelts (USDOI 1970). Elephant seals were hunted for oil; these hunting enterprises resulted in local extirpation of fur and elephant seals.

During California's gold rush era and the population growth it spawned, the Farallon Islands were heavily harvested for eggs. One of the egg companies of the period reputedly gathered and sold close to four million common murre eggs between 1850 and 1856 (USDOI 1970). Murres were

targeted because they would lay again if their first (single-egg) clutch was taken. Ainley and Lewis (1974) estimated that 400,000 murres bred at the Farallones in the middle of the nineteenth century (Ainley and Boekelheide 1990). By 1910, only 20,000 murres remained (Boekelheide et al. 1990a). Restrictions by the Secretary of Interior in 1890 led to the eventual ban of egg harvesting on the Farallons.

San Francisco's expansion as a major seaport in the early 1800s led to the need for lighthouses to prevent shipwrecks and provide navigation safety. The Lighthouse Service constructed the first Fresnel lens lighthouse on SEFI in 1855. The lighthouse keepers, along with their families, lived on the island to operate the lighthouse. The lighthouse was fueled by oil and kept lit from dusk until dawn each day. Following the construction of the lighthouse, a coal-fired steam fog signal was built. A narrow gauge rail line was laid from North Landing and Southeast Landing to the keepers' quarters at the base of the lighthouse to carry coal and other freight by mule power (White 1995). Lighthouse Service keepers (and their families) maintained the lighthouse until 1939, when its function was given over to the U.S. Coast Guard (USCG) (White 1995). In 1965, the USCG removed families from the island to reduce cost, and in 1969, the light was modernized with a rotating beacon (White 1995). In 1994, the light was equipped with solar power; the USCG has gradually decreased its involvement and management on SEFI since that time.

In 1903, the U.S. Weather Bureau constructed a weather station on SEFI to broadcast weather reports to the mainland for mariners. Initially, an undersea cable was laid from the island to Point Reyes Weather Station to provide these reports. The Navy later took control of the station and installed a manned radio station in 1905, which provided a vital communication point during World Wars I and II and the 1906 earthquake. All messages in and out of the devastated city went through Farallon Station. The military continued presence with gun emplacements on SEFI from 1905 through the end of WWII.

Farallon Islands from Point Reyes National Seashore

Theodore Roosevelt established Middle Farallon, the North Farallons, and Noonday Rock as the 24th refuge in the country in 1909 through Executive Order 1043. SFI was added in 1969 under Public Land Order 4671. In 1974, Public Law 93-550 designated all the islands, except for SEFI, as Farallon Wilderness Area, totaling 141 acres. The American Bird Conservancy named the Farallon Islands a Globally Important Bird Area in 2001. The Refuge was established to protect breeding seabirds and pinnipeds.

Biologists from PRBO Conservation Science (PRBO) first visited the islands in 1967 and have maintained a permanent presence since 1968. In 1971, PRBO and the Service began joint protection, monitoring, research, and management of the Refuge through a cooperative agreement. Also in 1971, California designated the islands a state refuge up to one nautical mile from the coast line of each island, prohibiting use of firearms and taking of birds and mammals from navigable waters within the refuge. Today, the waters surrounding the Farallon Islands are managed by the National Oceanic and Atmospheric Administration (NOAA) as part of the Gulf of Farallones National Marine Sanctuary (GFNMS). The waters are a heavily trafficked area with about 3,000 to 4,000 large vessels transiting the Gulf annually, using three separate navigation/traffic lanes maintained by the USCG.

Physical Setting

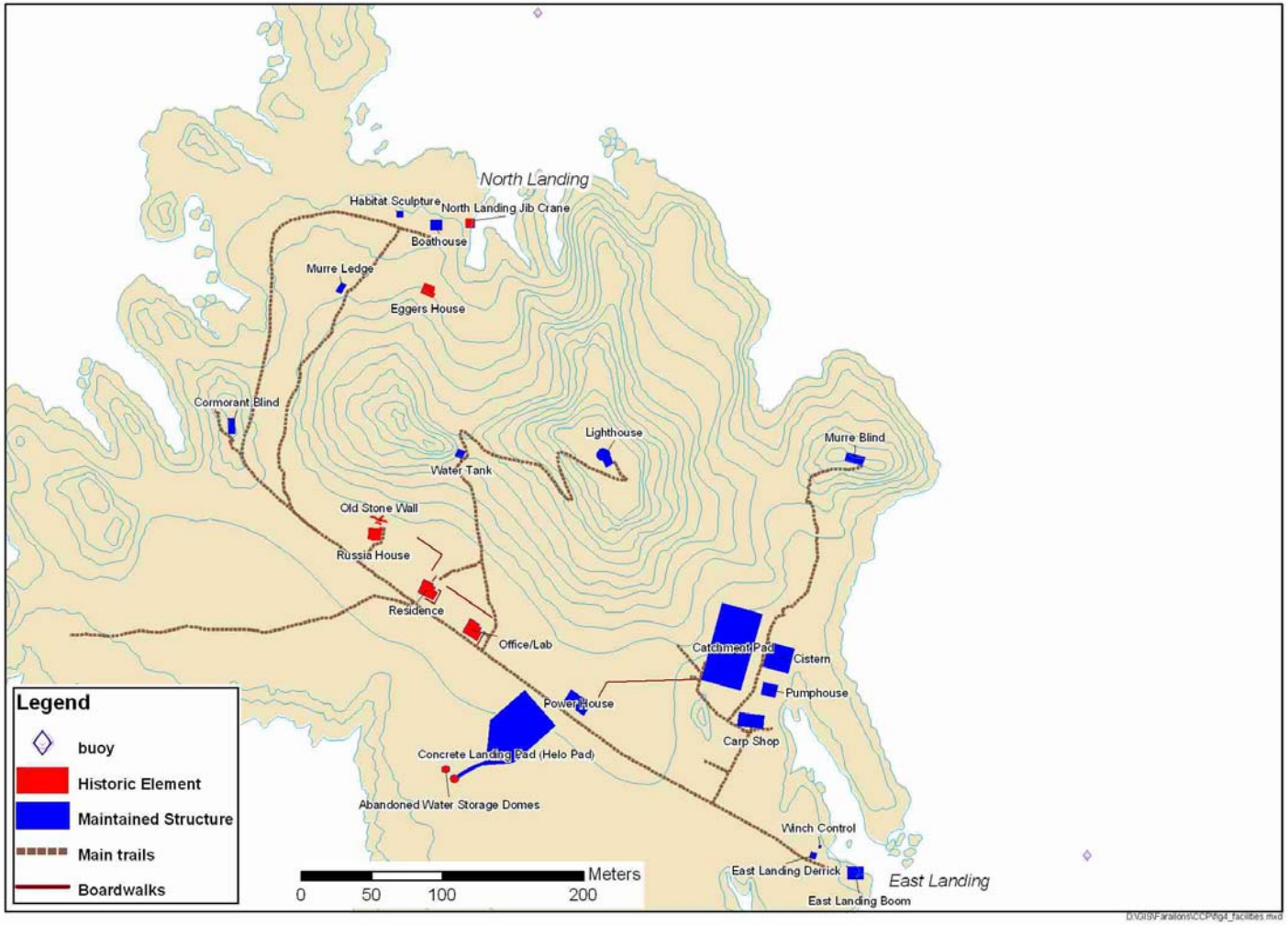
Due to the steep, rocky shoreline and sensitivity of wildlife, the Refuge remains closed to public access. The Farallon Islands are a granitic outcrop that is part of the Farallon Ridge; consequently, much of the surface area is rocky. Of the four island groups, SFI is the only one that has supported structures from earlier times that have been maintained or renovated for Refuge management purposes. These structures are concentrated on SEFI and comprise two residences, a powerhouse, carpenter shop, boat house, wildlife observation blinds, water collection/distribution system, and other infrastructure for support of the field station (See Figure 4). The lighthouse continues to be powered by solar panels and batteries, which are maintained by the USCG.

Vegetation on the Refuge is limited due to poor soil development. The dominant native plant is maritime goldfields (*Lasthenia maritima*), also known as "Farallon weed" by island residents. It is an important nest building material for cormorants and gulls. While floral diversity is limited, invasive plants on the Refuge require removal on a regular basis.

The Refuge supports the largest seabird nesting colony in the contiguous United States. There are 13 species of nesting seabirds and five species of marine mammals that pup or haul out on the Refuge.

The North Farallons, Middle Farallon, and Noonday Rock are virtually inaccessible, even by boat. The only onsite biological investigation of the North Farallons took place in 1994 (McChesney et al. 1994).

Figure 4. Southeast Farallon Island Facilities



Refuge Purposes

The purpose of a refuge is defined when it is established or when new land is added to an existing refuge. When an addition to a refuge is acquired under an authority different from the authority used to establish the original refuge, the addition takes on the purposes of the original refuge, but the original refuge does not take on the purposes of the addition. Refuge managers must consider all the purposes. However, purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants and their habitats take precedent over other purposes in the management and administration of a refuge.

The 1997 Improvement Act directs the Service to manage each refuge to fulfill the mission of the Refuge System, as well as the specific purposes for which that refuge was established. Refuge purposes are the driving force in developing refuge vision statements, goals, objectives, and strategies in the CCP. Refuge purposes are also critical to determining the compatibility of all existing and proposed refuge uses.

The Refuge's purposes are defined below in accordance with the Executive Order that established the Refuge and the 1997 Improvement Act.

"…as a preserve and breeding ground for native birds" (Executive Order 1043, dated Feb. 27, 1909).

"…for wildlife purposes." (Public Land Order 4671)

"... wilderness areas ... shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness: ..." 16 U.S.C. § 1131 (Wilderness Act)

Southeast Farallon Island

Ecosystem Context and Related Projects

To the extent possible, a CCP will assist in meeting conservation goals established in existing national and regional plans, state fish and wildlife conservation plans, and other landscape-scale plans covering the same watershed or ecosystem in which the refuge resides (602 FW 3.3). There are coastal and marine management plans in place for areas in and near the Refuge's location off the San Francisco coast, and are described below. Moreover, the goal identified for all Service activities in the Central Valley/San Francisco Bay Ecoregion (the ecoregion nearest the Refuges) is "to restore, conserve, and protect the ecological systems and biological diversity of the Central Valley/San Francisco Bay Ecoregion for present and future generations" (Medlin et al. 1996). The purpose of establishing these ecoregions is to develop and implement goals, priorities, objectives, and actions that will ensure an "ecosystem approach" to fish and wildlife conservation.

Gulf of the Farallones National Marine Sanctuary Draft Management Plan

The Refuge is within the Gulf of the Farallones National Marine Sanctuary (GFNMS). The GFNMS was created to protect the extensive marine resources that this area provides to both marine organisms and humans. The GFNMS is governed by a management plan addressing three issue areas: resource protection, research, and interpretation and education. The management plan is currently being finalized and identifies strategies that will be implemented in a five -year timeframe. Resource protection in the GFNMS includes measures to disseminate marine resource regulations and policies to the public, conduct outreach and environmental education, implement additional law enforcement protection, coordinate policies for activities that could affect sanctuary resources, and improve contingency planning for emergency response.

The Draft Management Plans (DMPs) for the GFNMS contains information about the sanctuary's environment, priority management issues and actions proposed to address them, regulations, staffing and administration, operational and programmatic costs, and performance measures. The DMPs address important GFNMS programs addressing issues such as public awareness and understanding, conservation science, water quality, emergency response and enforcement, and maritime heritage. The final plans and EIS was released in September 2008, representing a major revision of each site's original management plan and are the result of several years of study, planning, and extensive public input.

Research goals for the GFNMS include research beneficial to resource management challenges; baseline studies for GFNMS populations and habitats; and monitoring studies. Interpretation and education activities managed by the Sanctuary consist of producing outreach materials, providing educational Sanctuary excursions, offering lectures and other programs, providing visitor facilities, and conducting outreach outside the Sanctuary. Many of the management actions and goals for the Sanctuary are similar to those of the National Wildlife Refuge System.

California Coastal National Monument Draft Resource Management Plan

In 2005, BLM approved a California Coastal National Monument (CCNM) Resource Management Plan to manage 20,000 rocks and small islands along the 1,100 miles of California coastline. The plan focuses on protection of scenic and geologic formations of the monument and the habitat they provide for seabirds, sea mammals, and unique vegetation. The plan also discusses provisions for research, education, and additional planning through collaboration, cooperation, and coordination with agencies and organizations that have natural or cultural resource management

responsibilities along the coast. The Farallon NWR is not included in the CCNM because it is managed by the Service. However, the purposes of the plan are consistent with the intent of the Refuge.

Luckenbach Restoration Plan

The Luckenbach Restoration Plan was developed in response to the leaking of an old freighter, the *S.S. Jacob Luckenbach* that sank in the Gulf of Farallones in 1953. Major oiling events have occurred every few winters since at least 1973-74. Because the owners of the *Luckenbach* were no longer viable, the federal Oil Spill Liability Trust Fund was used for claims of uncompensated costs associated with oil removal, natural resource damages assessment, restoration, and compensation. The Luckenbach Restoration Plan identifies projects to restore resources damaged by the vessel's oil impacts. Projects and relevant to this Refuge include nonnative house mouse eradication on SFI (described later in this document) and the Murre Colony Protection Project. The Murre Project focuses improving common murre breeding success by reducing human disturbance events at breeding colonies. These restoration projects were initiated to restore seabird populations that were impacted by the *Luckenbach* spills. These projects also have the indirect effect of improving common murre breeding population on the Refuge by reducing human disturbance and predation by other wildlife.

Marine Life Protection Act

California is currently in the process of implementing the Marine Life Protection Act in the central coast of California. Over the next few years, state agencies and other stakeholders will be working to designate Marine Protected Areas in central California, including the Gulf of the Farallones. Actions to limit activities to protect the Gulf of the Farallones could have beneficial effects for the Refuge because wildlife there relies heavily on the Gulf for foraging.

Threats and Opportunities

The Refuge is the largest seabird breeding colony in the contiguous United States and contains 30 percent of California's nesting seabirds, making it an extremely important wildlife conservation area. The Refuge also contains an estimated 50 percent of the global population of Ashy storm-petrel, a declining species of the Service's management concern. Historical numbers of seals and sea lions on the Farallon Islands are not known, but historical accounts suggest that tens of thousands of furs at a time were commonly harvested from the islands in the 1800s (White 1995). Sealing and egg collecting in the nineteenth century severely decimated the wildlife populations that relied on the islands, which have not yet recovered to historical numbers. The first fur seal pup born on the Refuge in more than 150 years was documented in 1996. Elephant seals only began pupping on the Refuge again in 1972.

Northern fur seal pup
© Adam Brown

The seabird colony has continued to face anthropogenic threats well into the twentieth century. Tens of thousands of murres in central California were drowned in gill nets between the late 1970s and mid-1980s. In the winter of 1986, the oil barge *Apex Houston* accidentally discharged some 26,000 gallons of oil while en route from San Francisco to Long Beach Harbor. About 9,900 seabirds were killed as a result of the spill, of which about 6,300 were murres (USFWS 2006). Until oil was removed from the sunken ship *Luckenbach* in 2002, oiled seabirds were frequently recorded on the Farallons during the winter. Most recently in November 2007, the Cosco Busan vessel accident resulted in the release of 53,000 gallons of oil into the San Francisco Bay killing and injuring thousands of birds, even some that were observed from the Farallons. These and other oil spills have adversely affected breeding seabird populations on the Farallons.

Nonnative vegetation brought onto SEFI appears to have compromised seabird breeding habitat. Refuge management continually removes nonnative vegetation throughout the year when appropriate. Also in certain years, warming ocean temperatures in the local area can contribute to reduced food supplies for seabirds and affect their productivity (Buffa 2005). Trawls by the National Marine Fisheries Service in June 2005 caught no rockfish, and fishermen noted an absence of krill and salmon near the island.

Conservation Priorities and Initiatives

The primary conservation priority for the Refuge is restoring the historical abundance of seabirds and marine mammals through natural processes. Many internal and external plans have been developed to support this conservation priority. The Service's Pacific Region Seabird Conservation Plan was developed in January 2005 to identify Service priorities for management, monitoring, research, outreach, planning, and coordination pertaining to seabirds on NWRs along the Pacific coast, including the Farallon Islands (USFWS 2005).

The conservation priorities for federally listed endangered and threatened species and migratory birds that occur at the Refuge are frequently reinforced by recovery plans, conservation plans, and the designation of critical habitat. Steller sea lions and California brown pelicans are the two listed species occurring on the Refuge. A revised recovery plan for Steller sea lions is currently being finalized by National Marine Fisheries Service (NMFS). A recovery plan for California brown pelicans, developed in 1983, details recovery actions for the species; however, this species is

currently being assessed for delisting. The recommendations in these recovery plans have been used to develop the objectives and strategies in this CCP.

The California Current Marine Bird Conservation Plan developed by PRBO addresses seabird conservation from an ecosystem perspective. It provides information on species and ecosystem features to identify gaps, develop conservation needs, and develop partnerships to fill these needs.

Adaptive Management

The Service acknowledges that much remains to be learned about the species, habitats, and physical processes that occur on the Refuge, and about the ecological interactions between them. It follows that uncertainty is an unavoidable component of managing natural systems because of the inherent variability in these systems and gaps in the knowledge of their functions. Adaptive management strives to reduce some of that uncertainty and improve management over time. It is an iterative process of evaluating and refining management based on the results of management activities and the status of the managed resource. The Service has been practicing adaptive management on the Refuge since 1991 and plans to continue the practice. Accordingly, the management scenario proposed in this CCP provides for ongoing adaptive management of the Refuge; its adaptive management component is described more fully in Chapter 6, *Plan Implementation*. The CCP may be amended as necessary at any time in keeping with the adaptive management strategy.

Chapter 2. The Comprehensive Conservation Planning Process

This CCP and the associated EA (Appendix D) for the Farallon NWR is intended to meet the dual requirements of compliance with the 1997 Improvement Act and NEPA. The development of this document was also guided by the Refuge Planning Policy outlined in Part 602, Chapters 1, 3, and 4 of the U.S. Fish and Wildlife Service Manual (USFWS 2000). Service policy, the 1997 Improvement Act, and NEPA provide specific guidance for the planning process. For example, Service policy and NEPA require the Service to actively seek public input during the preparation of environmental documents.

The Planning Process

Key steps in the CCP planning process are listed below and depicted in Figure 5.

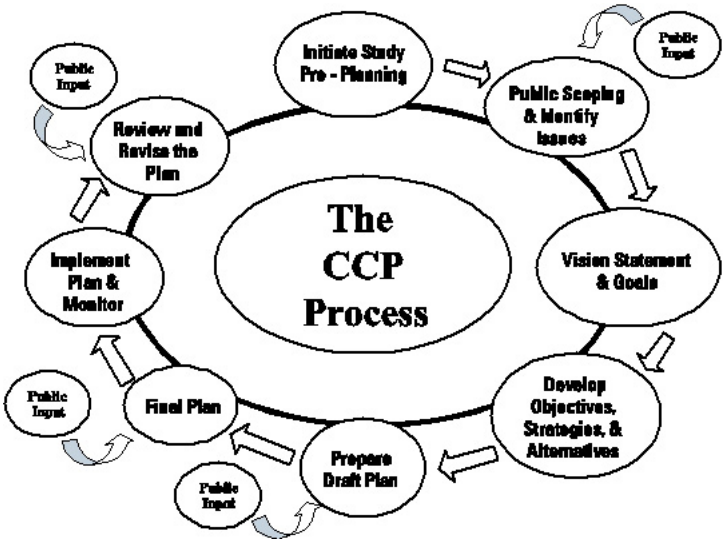
1. Preplanning.
2. Identifying issues and developing a vision statement.
3. Gathering information.
4. Analyzing resource relationships.
5. Developing alternatives and assessing environmental effects.
6. Identifying a preferred alternative.
7. Publishing the draft CCP and NEPA document.
8. Documenting public comments on the draft plan.
9. Preparing the final CCP.
10. Securing approval of the Regional Director.
11. Implementing the plan.

The CCP may be amended as necessary at any time in keeping with the adaptive management strategy. Major revisions would require public involvement and NEPA review, if necessary.

Preplanning

The planning process for this CCP began in December 2004 with the collection of pertinent data and selection of team members. A core team and an expanded team were formed to integrate stakeholder input into the planning process. Refuge staff identified five primary areas of focus: wildlife management, habitat management, wildlife-dependent recreation, environmental education, and cultural resources. These areas helped to encourage comments received from the public during the scoping period into potential objectives and strategies for the CCP.

Figure 5. CCP Process Chart



Planning Hierarchy

The Service planning hierarchy that determines the direction of the goals, objectives, and strategies is a natural progression from the general to the specific. Described as a linear process, the planning hierarchy is rather a multi-dimensional flow that is linked by the Refuge purposes, missions, laws, mandates, and other statutory requirements.

- The Refuge purposes provide direction for the Refuge.
- A Refuge vision broadly reflects the refuge purpose(s), the Refuge System mission and goals, other statutory requirements, and larger-scale plans as appropriate.
- Goals define general targets in support of the vision.
- Objectives direct effort into incremental and measurable steps toward achieving goals.
- Strategies identify specific tools to accomplish objectives.

In practice, the process of developing vision, goals, and objectives is iterative and dynamic. During the planning process or as new information becomes available, the plan continues to develop.

The Core Planning Team

The planning team responsible for leading the CCP effort included Service biologists, planners, and public use specialists from the San Francisco Bay NWR Complex. The members were responsible for researching and generating the contents of the CCP document and participated in the entire planning process. PRBO and USCG representatives were invited to participate in the core team because of their ongoing activities or infrastructure on the Refuge. Representatives from the California Department of Fish and Game (CDFG) were also invited to participate. Appendix O lists the members of the core team and other participants.

The Extended Planning Team

The extended team is the issue advisory forum for the CCP process. Its role is important because of the Refuge's history of networks and partnerships with local, state, and federal agencies; community groups; research institutes; and nonprofit organizations concerned with the Refuge. The extended team is composed of state and federal congressional officials, local government officials, nonprofit organizations, community groups, and other interested individuals. The goal of the extended team is to provide comments during the planning process, especially on the draft CCP.

Public Involvement in Planning

Public involvement is an important and required component of the CCP and NEPA processes. Public scoping meetings allow the Service to provide updated information about the Refuge System and the Refuge. More importantly, these meetings allow Refuge staff to hear public comments, concerns, and opportunities. Public meetings provide a forum for important discussion and identify important issues regarding the Refuge and its surrounding area.

The Refuge hosted a public meeting on May 25, 2005. Approximately 15 people attended this meeting. Comments were provided at the meeting as well as later by email and surface mail. The substance of the comments is summarized below.

As part of the CCP process, mailed updates are sent out to interested parties and stakeholders when significant benchmarks are achieved. The first update initiating the CCP process was mailed to approximately 67 individuals and organizations at the end of 2004. A second update summarizing public comments, a draft vision statement and draft goals was mailed to approximately 90 individuals and organizations in fall 2005. A third update summarizing CCP alternatives was mailed out in fall 2006 to approximately 110 constituents.

Issues, Concerns, and Opportunities

Recreation and Public Use

Comments regarding public access ranged from prohibiting all access (including Service staff) to allowing access for overnight camping. The majority of comments regarding recreation and public use discouraged any public access (only one comment supported public access). One comment suggested banning hunting, trapping, roads, vehicles, and mining. Other key activities suggested for prohibition included ham radio transmission and other uses that do not promote the Refuge's mission. Other suggestions included increasing fishing boat distance and making boat tours more financially accessible. Comments also supported limited guided tours, expanding volunteer opportunities, and offering overnight camping services for the public.

Habitat and Wildlife Management

Recommendations on protecting wildlife, especially endangered species, focused on reducing or eliminating nonnative plants and wildlife. Comments advocated both expanding partnership opportunities for research related to management and limiting scientific activity on the Refuge.

Environmental Education

A number of comments suggested installing a web-based camera as a tool for environmental education. Such a webcam could be used in conjunction with a real-time web page describing current conditions and wildlife breeding information on the Refuge. Another comment suggested developing educational materials and conducting educational programs at schools and organizations. One comment suggested coordinating outreach with other similar interpretive centers and expanding work with existing visitor centers that contain Farallon materials and information.

Management Concerns

Staff and partners identified several challenges and needs for the Refuge. They recognized that the Refuge's remote location offers the seclusion necessary for successful seabird breeding and an environment for fledging young with little human disturbance. By the same token, its remote location and highly variable weather conditions can impede impair access for management activities. The spread of invasive nonnative vegetation, avian predation, and anthropogenic factors (including climate change) are the primary challenges identified by Refuge staff.

Invasive Vegetation

Past human activity brought a variety of nonnative plant species to the Refuge. Birds have served as vectors, generally carrying propagules for use as nesting material. The harsh marine environment has limited the range of nonnative species that can readily become established; New Zealand spinach (*Tetragonia tetragonioides*) and cheeseweed (*Malva* spp.) have been the focal point of control efforts to date.

A Weed Management Plan (Appendix N) was developed in 2004; however, nonnative vegetation continues to effectively disperse seeds and develop on the Refuge. There has been some success in keeping nonnative vegetation from expanding by managing infestations through herbicide application and hand-pulling, but a strategy should be developed for implementing restoration of native species following removal of nonnatives. Preventing reintroduction of nonnative species will be an integral component of such a strategy.

Disturbance

The Refuge is currently closed to the public. Because of its distance from the mainland and the field station staff that warns off boats that approach too closely, trespassing occurs only occasionally. Island personnel intercept an average of one party every other year landing or attempting to land on the Refuge.

Human disturbance from aircraft and boat activities is a greater concern that can cause wildlife to flush. During an average year, island staff document roughly ten boats violating the seasonal boat closure, which prohibits coming within 300 feet of the shoreline during the nesting season. Several aircraft usually fly low enough over the islands every year to potentially cause wildlife disturbance.

Avian predation is a regular occurrence. Peregrine falcons do not breed on the Refuge, but one to four peregrine falcons are usually present during the winter, early spring, and fall months. Peregrines feed on a variety of birds species at SEFI. Western gulls prey on chicks of

neighboring gull nests and unattended murre eggs/chicks—for example, when human activities too close to nesting colonies flush the adults. Small seabirds such as auklets and Ashy storm-petrels are nocturnal and burrow-nesting—adaptations that help them avoid predation by gulls. Even so, gulls predate them regularly as they enter and leave nesting burrows and crevices that are situated close to gull nests.

Most avian predation probably does not affect overall populations, but there are exceptions. Certain individual gulls become "storm-petrel specialists," killing large numbers of adult Ashy storm-petrels in a single season, sometimes even lining their nests with petrel parts (Sydeman et al. 1996). Furthermore, overwintering burrowing owls, artificially supported by nonnative mouse populations in fall, turn to eating Ashy storm-petrels when mouse populations crash in late winter/early spring. This sustained predation on adults of such a slowly reproducing, narrowly distributed species is a management concern because Ashy storm-petrels had a declining trend on the Farallon Islands through the 1980s and 1990s. Management options include selectively removing problem gulls and relocating overwintering burrowing owls to the mainland. Although some owls have been translocated to the mainland over the last few years, they remain hard to capture and often difficult to detect until they have killed large numbers of storm-petrels. The Service is evaluating a longer term solution of eliminating nonnative house mice; this approach would benefit other refuge resources as well.

Climate Change

Increasing carbon dioxide and other greenhouse gas emissions from anthropogenic sources have undeniably altered the temperature over the last century more than any other time in history. Such temperature changes can have different consequences worldwide from sea-level rise to greater meteorological fluctuations. The Service recognizes that a changing climate will impact natural resources on Refuges and has been charged by Congress (H. CON. RES. 398) to address these impacts in CCPs. Anticipated impacts may include: species range shifts, species extinctions, phenological changes, and increases in primary productivity. This challenge is especially important at the Farallon Refuge which is surrounded by the water. Management planning for the Refuge will need to incorporate climate change impacts into land management activities.

Burrowing Owl
USFWS

Invasive Wildlife

When SFI was added to the Refuge in 1969, feral European rabbits (O*ryctolagus cuniculus*), cats (*Felis catus*), and nonnative house mice (*Mus musculus*) were present on the island. European rabbits were introduced to SFI sometime before 1857 (White 1995). Earlier inhabitants considered them both an important food source and a nuisance; they burrowed beneath and undermined structures and gnawed electrical wiring. Poisoning and shooting campaigns prior to 1969 periodically reduced their numbers but did not eradicate them. Because rabbits competed with burrow-nesting birds for space and destroyed native vegetation, the Service implemented management actions to remove them. This program ended successfully with the last rabbit being removed in January 1975. Similarly, because feral cats preyed on seabirds, they were also removed shortly after the Service assumed management of SFI.

House mice are currently the only introduced vertebrate remaining on SFI. Varying seasonally, their populations are highest in the fall and lowest in the late winter/early spring after winter rains flood their burrows. Although island managers do not know when mice were first introduced to SFI, anecdotal evidence suggests that they arrived early in the sequence of European human activities, which began in the late 1700s. Russian sealers, egg collectors, lighthouse keepers, the Navy, and the USCG all inhabited the island before the Service assumed management; any of these previous occupants could have introduced mice, presumably by accident.

Mice feed on native plants, invertebrates, and seabirds (A. Hagen unpub. data; Ainley and Bockelheide 1990); they spread nonnative seeds; and they damage supplies and infrastructure. More recently, the Service has become concerned that mice are indirectly responsible for a substantial portion of an ongoing decline in the breeding population of Ashy storm-petrel, by being a temporary food source for migrating burrowing owls. In the absence of the mouse population, burrowing owls that arrive in fall would leave the island after a short stay finding no sustainable food source, as do other migrating raptor species, which do not cause major predation problems.

Infrastructure

The Refuge's remoteness, precipitous rocky shoreline (which precludes construction of a dock), rough sea conditions, and drastically fluctuating weather conditions make transportation logistics for personnel and supplies extremely difficult. Boats are the main mode of transport, but electric and hand-operated derricks at the East and North Landings, respectively, are the only means of transferring personnel and cargo to the island. Because the protected coves where these landing devices are located are too shallow for arriving boats, a labor-intensive transfer from the arriving boat to the Refuge motor boat to a personnel lifting device (East Landing) or small platform (North Landing) is required. The transfer operation requires a minimum of three island personnel to operate the equipment, and a boat landing typically takes a minimum of 6–8 hours of staff time to prepare for and complete. The landing operation can only be safely performed during calm seas. Because sudden changes in ocean and weather conditions are common and the one-way trip from the mainland to SFI takes 3–5 hours, arriving boats, on occasion, are unable to safely unload and must return to the mainland with personnel and cargo that was intended for delivery, often after considerable staff time has been spent in preparation.

Helicopters can land on the former water catchment pad, but landings are not allowed during the nesting season (March 15–August 15) to protect wildlife from disturbance during this sensitive time period. Helicopter access during the fall and winter months is often unpredictable due to fog or winter storms. Helicopters are allowed to access the Refuge only along a designated route to prevent flushing of pinnipeds, brown pelicans, and seabirds.

Water Catchment Pad
USFWS

Sea spray, high winds, and large deposits of bird guano create a harsh marine environment that corrodes even the most durable materials and causes unavoidable wind damage to infrastructure. Critical infrastructure components such as the landing derricks, power generating equipment, and water collection/distribution facilities need to be constantly maintained and repaired. The field station's remoteness and the difficult and unpredictable access make service calls by qualified personnel costly and difficult to arrange.

Much of the infrastructure on SFI was constructed prior to the Refuge assuming management. Consequently, repairs and upgrades have been challenging, and have often, by necessity, been carried out in a rather makeshift fashion. For example, the Refuge began to collect rainwater for all its water needs in 1998 by rehabilitating the catchment pad and other components that are 40–100 years old. Major replacement of water lines, water tanks, and pumps are slowly being conducted, but still continue to be a priority.

The roof of the powerhouse, which contains photovoltaic equipment and generators that power the derrick, leaked and was reroofed in 2008. In addition, the photovoltaic system was reconfigured for safer roof access. The two residences are listed in the National Register of Historic Places, and any repairs must maintain their historical character. Both were reroofed, re-sided, and fitted with double pane windows in 1999. The interior of the primary residence is in good condition; however, the interior of the secondary residence is in poor condition, and it is unheated. A new septic system was installed in 2005, but all water pipes in both houses are in serious need of replacement.

Development of Refuge Vision

A vision statement is developed or reviewed for each individual refuge unit as part of the CCP process. Vision statements are grounded in the unifying mission of the Refuge System and describe the desired future conditions of the refuge unit in the long term (more than 15 years). They are based on the refuge's specific purposes, the resources present on the refuge, and any other relevant mandates.

Development of Refuge Goals, Objectives and Strategies

The purpose for creating the Refuge was established by law, Executive Order, and other mechanisms described in Chapter 1. The 1997 Improvement Act directs that the planning effort develop and revise the management focus of the Refuge within the Service's planning framework—that is, the Service mission, the Refuge System mission, ecosystem guidelines, and refuge purposes. This is accomplished during the CCP process through the development of goals, objectives, and strategies.

Goals

Refuge goals are necessary for outlining the desired future conditions of a refuge in clear and succinct statements. The Refuge System defines goals as a "…descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units" (602 FW 1). Each goal is subdivided into one or more objectives that define these desired conditions in specific, measurable, and time-bounded terms. A well-written goal directs work toward achieving a refuge's vision and, ultimately, the purpose(s) of a refuge. Collectively, a set of goals is a framework within which to make decisions. Interim refuge goals developed when the Refuge was established are listed below.

- Restore wildlife populations to historic levels.
- Monitor and protect seabird colony.
- Monitor and protect pinniped colony.
- Monitor land bird migrants.

These interim goals were evaluated and expanded through the CCP process as discussed in Chapter 5, *Management Direction*.

Objectives, Rationale, and Strategies

After the Refuge goals have been reviewed and revised, various objectives, a rationale, and strategies are developed to accomplish each of the goals.

Objectives: An objective is defined as a "concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work" (602 FW 1). Objectives are incremental steps taken to achieve a goal. They are derived from goals and provide a foundation for determining strategies, monitoring refuge accomplishments, and evaluating success. The number of objectives per goal can vary, but should be developed to comprise those necessary to satisfy the goal. In cases where there are many objectives, an

implementation schedule may be developed. All objectives must possess the following five properties: specific, measurable, achievable, results-oriented, and time-fixed.

Rationale: Each objective should be supported by a rationale. The degree of documentation can vary, but at a minimum, the rationale should include logic, assumptions, and sources of information. Articulating a rationale promotes informed debate on the objective's merits, provides continuity in management through staff turnover, and allows reevaluation of the objective as new information becomes available.

Strategy: A strategy is a "specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives" (602 FW 1). Well-written goals, objectives, and strategies direct work toward achieving the Refuge's vision and purpose. Multiple strategies can be necessary to support an objective.

Development of Alternatives

The CCP process includes the development of a range of reasonable alternatives that can be implemented to meet the goals of the Refuge System and the purpose of the Refuge. The Refuge System defines alternatives as "…different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues…" (602 FW 1). NEPA also requires analysis of a *no-action alternative*, which constitutes a continuation of current conditions and management practices. Development of action alternatives is based on consideration of input from the scoping period, as well as on input from the planning team and other Service staff. The EA (Appendix D) describes the development of alternatives, assessment of their environmental effects, and identification of the preferred management alternative (proposed action). Once a preferred alternative is selected, it is developed as the objectives and strategies of the CCP.

Four alternatives were identified for analysis; these are discussed in detail in the EA (Appendix D). Additional alternatives were considered but eliminated from detailed analysis; these are discussed below.

Alternatives Considered but Eliminated from the Detailed Analysis

No Staff Occupation

Eliminating all staff occupation of the Refuge was considered but eliminated from detailed analysis because it would conflict with the Refuge purpose of protecting and restoring seabird populations. Prohibiting staff occupation would severely limit Refuge staff's research and monitoring efforts. While wildlife may enjoy increased habitat area due to reduced human interaction, they would likely experience an increased amount of aircraft and boating disturbance in the absence of existing staff surveillance and enforcement. Without the small but vigilant human presence on SEFI to prevent boats and aircraft from approaching too close to the island, seabirds and marine mammals would be flushed from nesting colonies, possibly during critical times in the breeding season.

Aircraft flying below 1,000 feet over the island and boats approaching too close to the shoreline, have been observed flushing seabirds and marine mammals, and are therefore treated as potential

violations of Service regulations. When such an incident occurs, island personnel immediately attempt to make contact with the pilot or skipper, advising them to alter their activities or face a potential citation. A vessel description, identification numbers, activity description, and any wildlife disturbance are carefully noted and sent to Refuge law enforcement or other appropriate enforcement agencies. Refuge officers follow up with appropriate action—either a warning or a citation. This approach has been successful in reducing the number of low-level flights from an average of 5–10 per year prior to 2002 to three or fewer incidents per year more recently.

The California Code of Regulations prohibits boats from approaching within 300 feet of the shoreline between March 15 and August 15. Due to the Refuge's remoteness and unpredictable sea conditions, this regulation is difficult for CDFG to enforce. Island personnel are in contact with fisherman and other boaters on a daily basis, informing them of the regulations and documenting any violations. Approximately 8–10 boating violations of the CDFG closed area are recorded each year, several of which cause some level of wildlife disturbance.

The frequency and magnitude of human-caused disturbance would increase if personnel were removed from the Refuge. Prior to Refuge establishment of a human presence in the 1960s, the USCG informed the Service that quite a few people landed on the islands at various times to the detriment of nesting colonies of Brandt's cormorant, whose nestlings were consequently heavily predated by gulls (Gene Kridler pers. comm. July 2, 2005). Under current conditions, people who occasionally try to land on the island are intercepted and escorted away before they cause significant damage.

Because many seabirds lay only one egg per year, even one human disturbance event during a critical time of the nesting season (egg laying, chick rearing) can cause reproductive failure of cliff-nesting species (e.g., common murre) for that season. Repeated disturbances could cause abandonment of an entire colony.

If a human disturbance event were to involve the introduction of a mammal (e.g., cat, rat, or even rabbit), such an introduction could lead to extirpation of other burrowing seabirds as well. The consequences of introduced mammalian predators and competitors on island species are well documented. Prior to Refuge acquisition of SEFI in 1969, nonnative cats and rabbits were present. Following their removal, ground-nesting seabird populations began to rebound and rhinoceros auklet returned as a nesting species.

Without a small staff on the island, the Service would be unable to document and respond to off-Refuge events that affect Refuge wildlife. Long-term monitoring of common murre populations and documented gillnet mortality contributed to closure of the near-shore gillnet fishery in 1987. In 2003, island personnel documented the emergence of squid fishing close to the island and its potential effects on nocturnal seabirds such as Ashy storm-petrels and Cassin's auklets. Following presentations by Refuge and PRBO staff to the California Fish and Game Commission, the waters surrounding the Refuge were closed to night fishing.

Oil spills are another threat to seabirds in general, and common murres in particular, that nest on the Refuge. Refuge personnel record all oiled wildlife daily, reporting any unusual incidents or increases to the Oil Spill Prevention and Response Division of CDFG. When a spill event is suspected, Refuge staff collect oiled birds or carcasses for evidence. Several successful cases (i.e.

Apex-Houston, Command, Luckenbach) resulting in large financial settlements and restoration of seabirds and habitat, have been based on documentation collected by Refuge staff.

Removing the human presence on the island would also impede the Service's ability to fulfill its public outreach mission. Journalists and other media personnel are periodically granted access to write articles or to film news segments and documentaries. Refuge staff people have intimate knowledge of resident wildlife and can supervise these limited access events in a manner that greatly reduces disturbance while at the same time allowing the public an opportunity to learn about the Refuge's resources. Refuge staff also communicate with charter boat operators that bring people out to see the Refuge from the water.

The combination of restricted public access and staff presence has facilitated the recolonization of once extirpated species to the Refuge. Historical estimates indicate that at least 500,000 common murres and thousands of northern fur seals once populated the Farallon Islands. Fur seals have only recently returned as a breeding species after an absence of more than 150 years. Common murres have slowly rebuilt from a low point of just a few thousand in the early 1900s to more than 250,000 today. Wildlife still remains vulnerable to human disturbance, nonnative species, oil spills, and other off-Refuge events that cannot be predicted. Removing island staff (and consequently removing impediments to unauthorized public access) would reverse gains in wildlife restoration that have occurred since the Refuge was established. Removing island staff would also disrupt 40 continuous years of wildlife research and monitoring which has been conducted on the Refuge and is critical to the management of Refuge resources.

Seasonal Staff Occupation
Seasonal staff occupation (i.e., allowing access only during non-nesting or other non-sensitive periods) was eliminated from detailed analysis because it would conflict with the Refuge's purpose of protecting and restoring seabird populations. Seasonal limitations on access would impede Refuge staff's research and monitoring efforts. Moreover, the seasonal absence of staff would remove substantial protection of wildlife from human disturbance. Continual staff presence on SEFI has resulted in prevention of boating and aircraft disturbance, and has facilitated citation and prosecution of offenders. Finally, the infrastructure (e.g., the landing derrick) required to access SEFI requires continual upkeep. Seasonal absence of staff would impede with the necessary maintenance.

Unlimited Public Access
Unlimited Public Access was eliminated from detailed analysis because of resource sensitivity, safety concerns, logistical constraints, and incompatibility with Refuge purposes. Open public access would be an inappropriate basis for management due to the unpredictability of weather, the inherent limitations of equipment, the safety challenges of accessing the Farallons, and the sensitivity of the wildlife. Providing open access would require a larger staff to host visitors. SEFI would be the only island where access could be allowed because it has equipment to transport visitors to its shore. As previously discussed, access requires significant support from island staff; however, because of the unpredictability of weather, tides, and equipment, visitors could not be assured of access.

Allowing open public access would also cause unknown wildlife and habitat disturbance. The majority of land on SEFI is used by wildlife as haul-out, roosting, and nesting sites. Nests and

burrows occur throughout the Refuge and are easily damaged by human traffic. Adults are also sensitive to disturbance, which can result in abandonment of nests or young. Public access would undoubtedly result in habitat loss and declining wildlife populations.

Selection of the Refuge Proposed Action

The alternatives were analyzed in the EA (Appendix D) to determine their effects on the Refuge environment. Based on this analysis, Alternative C was selected as the proposed action because it best achieves the Refuge goals and purposes in accordance with Refuge System and Service missions. Alternative C is founded upon the need for restoring habitat, protecting wildlife, and focusing research and monitoring programs on priority needs. The alternative also integrates environmental education, outreach, and wildlife-dependent recreation objectives that will connect the public to such a remote Refuge. The management plan set forth in Alternative C is described in Chapter 5, *Management Direction*, and Chapter 6, *Plan Implementation*.

Plan Implementation

The CCP will be reviewed by Refuge staff to coordinate annual work plans and update the Refuge Operational Needs System database. This database describes the unfunded budget needs for each refuge and is the basis upon which the Refuge receives funding increases for operational needs. The CCP may also be reviewed during routine inspections or programmatic evaluations. Results of the reviews may indicate a need to modify an integral part of plan implementation, and management activities may be modified if the desired results are not achieved. If minor changes are required, the level of public involvement and NEPA documentation will be determined by the Refuge manager. The CCP will be formally revised about every 15 years.

Chapter 3. Refuge and Resource Description

Geographic/Ecosystem Setting

Located along the Pacific Flyway, the Farallon Islands is an ideal breeding and roosting location for wildlife off the California coast. Historically, seabird populations exceeded 500,000, and tens of thousands of marine mammals used the islands. The Farallon Islands have also been the site of extensive human activity, as described in Chapter 1, *Introduction and Background*.

Physical Resources

Climate and Air Quality

The San Francisco Bay Area climate is characterized by moderately wet winters and dry summers. In winter, the Bay Area experiences periods of storminess and moderate to strong winds, as well as periods of stagnation with very light winds. Winter rains (November through April) account for about 90 percent of the average annual rainfall. The summer climate of the west coast is dominated by a semi permanent high-pressure system centered over the northeastern Pacific Ocean. Because this high-pressure cell is so persistent, storms rarely affect the California coast during the summer. (BAAQMD 2004).

On the Farallon Islands, spring and early summer are characterized by strong northwesterly winds. The temperature is relatively constant throughout the year, rarely below 45°F or above 65°F. Most of the annual rainfall occurs during winter (with a seasonal average of 10 inches), and there is frequently dense fog on the Islands in late summer. The average sea surface temperature surrounding the Farallon Islands is approximately 53.5°F (Buffa 2005).

The Farallon Islands are not monitored for air pollution by San Francisco County. Air quality directly surrounding the Farallon Islands is considered good due to marine winds and the relative isolation that keeps air pollutants from entrapment in the Islands. This area is described as meeting state and federal air quality standards. In the northern part of San Francisco County, pollutant emissions are high, but winds are generally sufficient to carry the pollutants away before they accumulate (BAAQMD 2004).

The state and federal governments have developed attainment standards for the six criteria pollutants listed below. Areas that do not meet the standards are designated as nonattainment areas; those that do are designated as attainment areas.

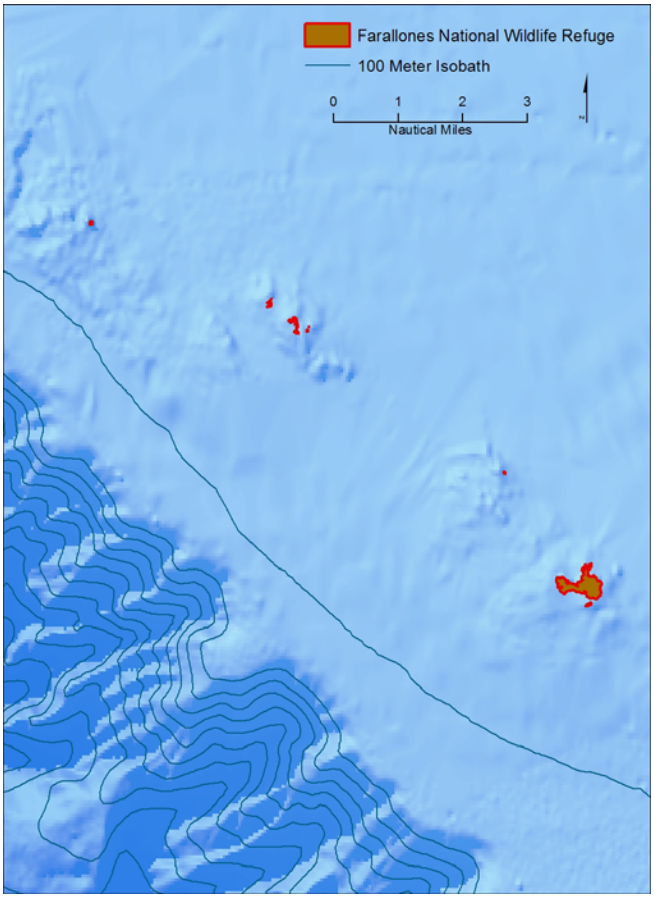
- Particulate matter less than 10 microns in diameter (PM10)
- Ozone
- Carbon monoxide (CO)
- Nitrogen dioxide (NO_2)
- Sulfur dioxide (SO_2)
- Lead

The nearest Air Basin to the Refuge is the San Francisco Bay Area Air Basin. The San Francisco Bay Area Air Basin is an attainment area for state and federal CO, NO_2, SO_2, and lead standards. It is a nonattainment area for state and federal ozone standards and state PM10 standards. Attainment reports are unknown for federal PM10 standards (BAAQMD 2004). However, because the Refuge is far from urban areas, it is not directly impacted by most urban emissions. Moreover, with the preponderance of energy for Refuge operations is supplied by solar power, the Refuge generates virtually no emissions.

Topography

The Farallon Islands were at one time hills near the coastline of the San Francisco Bay region (Chin and Graymer 2001). At the end of the last ice age (approximately 10,000 years ago), melting ice sheets caused a worldwide rise in sea levels, forming the Gulf of Farallones and the San Francisco Bay (Chin and Graymer 2001). The Refuge sits at the edge of the drop-off into the outer continental shelf (See Figure 6), roughly 3,500 to 4,000 meters deep (Karl et al. 2001). The present-day Farallon Islands comprises 211 acres of mostly rock habitat that is terraced and rises 60–70 meters above the sea floor. SFI encompasses approximately 120 acres; it is approximately 1 mile long and 0.5 mile wide at the widest point (Hoover 1932). The highest point on SFI is lighthouse, which stand approximately 110 meters above sea-level.

Figure 6. Bathymetric Map



The Middle and North Farallon Islands are very steep granitic rock and are virtually inaccessible. Middle Farallon is a single rock 46 meters in diameter and 6 meters high (Coast and Geodetic Survey 1951). Its low profile and constant wave action preclude nesting by birds, although seabirds have been observed roosting there (Buffa pers. comm.). Waters surrounding Middle Farallon support a rich marine life, as evidenced by frequent flocks of feeding birds. The North Farallons is a cluster of four rocky islands that are steep, jagged and difficult to access. The highest point on the North Farallons is about 47 meters above sea level (Thoresen 1959). The East Island of the North Farallons is steep, but the top is relatively flat (McChesney et al. 1994). The North Farallons provides important habitat for cliff-nesting birds.

Noonday Rock is a submerged rock outcrop not suitable for nesting birds. It is the northwesternmost point of the Farallons, rising abruptly from depths of 20 fathoms, and is awash even at low tide, but shallow waters around the outcrop support rich marine life.

Buoy marking location of Noonday Rock
USFWS

Geology, Soils, and Hydrology

The geology of the Farallon Islands is primarily salt-and-pepper granite rock, with coarsely crystalline quartz diorite. Sugarloaf Rock, a small islet on the north side of SEFI, is a conglomerate of huge, rounded boulders and sandstone (Schoenherr et al. 1999). Phosphate minerals and diatom-bearing stalactites have been found on the Farallon Islands (Vennum et al. 1994). More than 40 phosphate minerals have been found in caves; the majority of these minerals are ultimately derived from the leaching of bat guano or, to a lesser extent, bird guano or bone breccia (Vennum et al. 1994). Coarse-grained hornblende-bearing biotite granodiorite and quartz diorite underlie SEFI and West End (Hanna 1951). This rock is strongly fractured and shattered with very closely spaced joints and shear planes, deeply weathered, and extensively coated with brown iron oxide (limonite) and clay minerals. Sea caves on the Farallons contain stalactites of

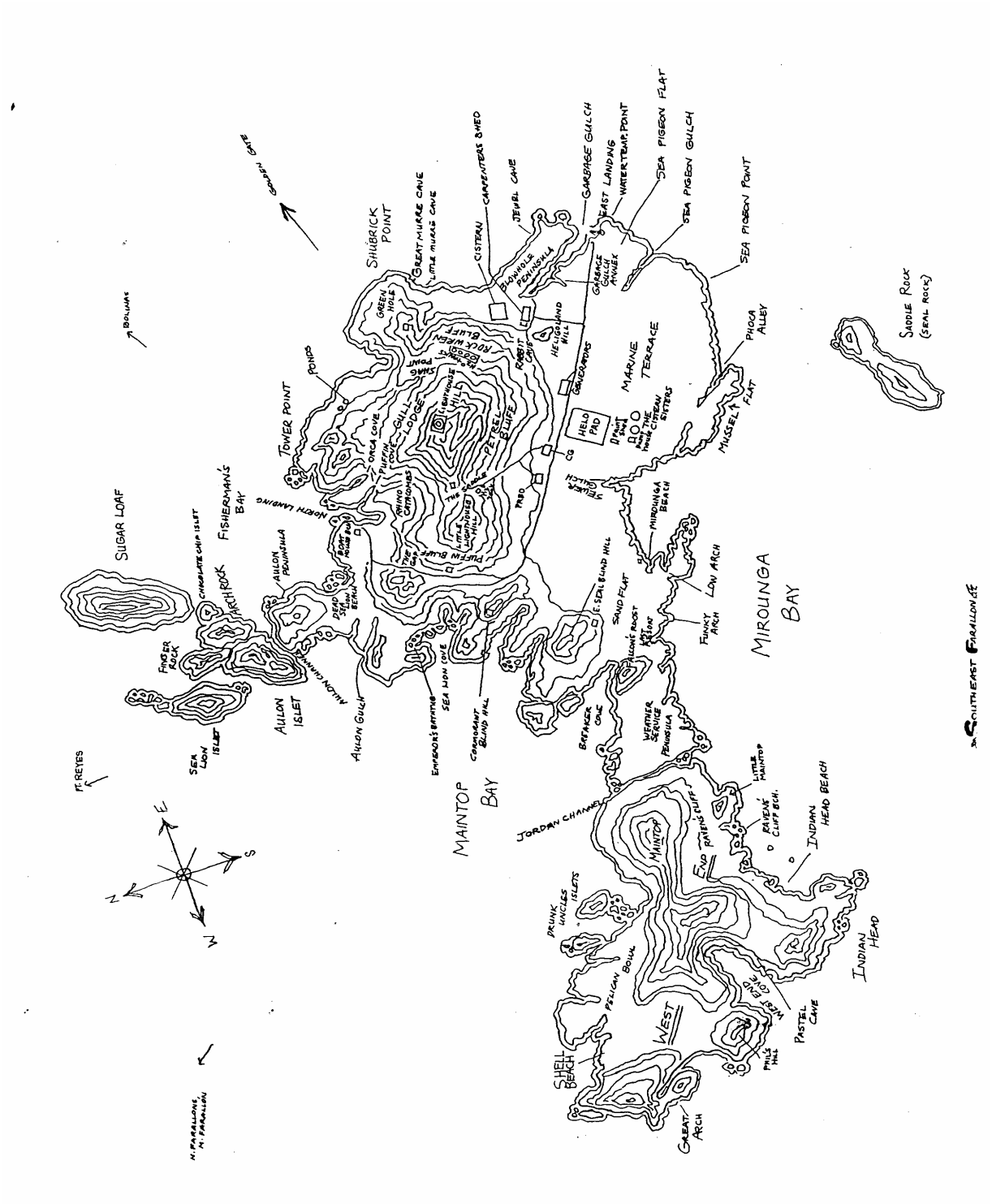
taranakite, one of the more common cave phosphate minerals (Hill and Forti 1986). The Farallon Islands are situated west of the San Andreas Fault on a geological terrane known as the Salinian Block, part of the Pacific Plate (Schoenherr et al. 1999).

Some portions of SEFI and West End have soil layers. The flat Marine Terrace (Figure 7) on the south side of SEFI is covered with dark brown soil up to 8 inches (20 cm) thick (Vennum et al. 1994). Examination indicates that these soils largely comprise decomposing guano; granitic sand; and lesser amounts of feather, bone fragments, vegetation, possible fish teeth, and human-made detritus (Vennum et al. 1994).

Hydrologically, the Farallon Islands are most affected by tides and currents. There are no groundwater sources. The only fresh water is supplied by rainfall, little of which is retained because most runs off the rocky substrate. The Farallon Islands are in the Gulf of the Farallones, which extends along the central California coast from Point Reyes southeast to Año Nuevo. The Gulf of the Farallones is above the continental shelf, which extends west from the mainland to the shelf break. The shelf is relatively shallow (less than 100 meters) until it breaks into the deeper continental slope with depths of 3,500–4,000 meters. The Gulf's western boundary is characterized by discontinuous pinnacles and islands of granitic rock belonging to the Farallon Islands chain and Cordell Bank. The waters surrounding the Farallons reach depths of 50–60 meters. (Chin and Graymer 2001.)

The islands are adjacent to the California Current, the biologically rich eastern boundary current that runs south along the west coast. Current patterns over the continental shelf tend to flow southeast and slightly offshore in the summer, causing nutrient-rich cool waters to upwell onto the shelf (Noble 2001). Shelf currents tend to flow northwest in the winter and do not bring deep, cold slope water onto the shelf. Instead, the coastal ocean tends to be a few degrees warmer in winter than in summer (Noble 2001). Tidal currents are strong over the shelf and tend to be the dominant features in the flow near coastal boundaries or within estuaries. The currents that flow over the continental shelf can be divided into two basic types: tidal currents and lower-frequency, subtidal currents. Tidal currents dominate the flow over the inner and middle parts of the shelf. Subtidal currents are generally smaller than tidal currents, but are responsible for moving nutrients and suspended material onto and off the continental shelf.

Figure 7. Site Description of South Farallon Islands



Water Supply and Water Quality

Since 1998, a rainwater collection storage and purification system has supplied all of the Refuge's water needs. Water is purified through a battery of filters, and samples are tested approximately four times a year by Alameda County Water District for total coliform, fecal coliform, and nitrates. Fecal and total coliform test usually produce negative results; nitrate and general bacteria levels meet guidelines. The water supply is used for personnel living on the Refuge and for general management operations. There is no current need for external sources of water. However, two or more back to back drought years could deplete water reserves.

The Refuge is surrounded by the GFNMS. Water quality within the GFNMS is generally good due to the rural character of the coastline (i.e., there are no major industrial discharges) and exposure of the coastline to the strong currents of the open ocean. Nevertheless, there are several potential threats to water quality in the Sanctuary. The rural estuarine habitats and adjacent coastal waters of Bolinas Lagoon, Tomales Bay, Estero Americano, and Estero de San Antonio are vulnerable to land-based nonpoint source pollution from livestock grazing, agricultural activities, past mining activities, and poorly maintained septic systems. In addition, the discharge of the San Francisco Bay Estuary is a source of pollution generated by 8 million people living in the Bay area, agricultural waste products from the Central Valley, and residual sediments and metals from the California gold rush era. These discharges may periodically have an impact on Sanctuary waters depending on coastal currents. Other potential threats to water quality include floating debris (e.g., plastics), accidental spills, and residual materials from historical ocean dumping (GFNMS 2003).

The waters surrounding the Farallon Islands were designated by the State Water Resources Control Board (State Water Board) in 1974 as an Area of Special Biological Significance (State Water Board 1974). In 2003, the state reclassified these areas as State Water Quality Protection Areas (SWQPAs). California's Ocean Plan (State Water Board 2001) prohibits waste discharges into SWQPAs unless authorized by an exemption. An untreated sewage discharge at SEFI, identified by the State Water Board as being in violation of the Ocean Plan, was eliminated with the installation of a septic system in 2005. The septic system treats all wastewater generated by the field station and disperses it into a leach field located a sufficient distance from the ocean to avoid pollution of the SWQPA.

Hazardous Materials and Contaminants

Hazardous waste and contaminants on SEFI were assessed in 2001 by GeoEngineers, Inc (GeoEngineers 2006). The assessment presented the conclusions listed below.

- Sample liquids from the sump near the aboveground storage tanks contained diesel-range petroleum hydrocarbons at 120 mg/L.
- Hazardous waste containers (most likely used for petroleum storage), currently stored on the spill containment pad in the former generator building, should be removed.
- A wipe sample of the former generator building determined that polycholorinated biphenyls (PCBs) were below the method detection limit of 0.5 µ/wipe.
- Subsurface soil samples behind the generator building exhibited diesel- and lubricating oil–range hydrocarbons at 2,000–35,000 mg/kg.

The aboveground storage tanks, liquid from the sump, and associated materials were removed from the Refuge and transferred to a hazardous waste removal facility on the mainland in 2002

and 2003. No regulatory standards exist for petroleum hydrocarbon in California soils for this type of setting because there is no groundwater interface. However, the Service chose to address the contaminated soils behind the generator building to ensure appropriate protection of resident wildlife. A passive bio-venting system was installed to remediate the petroleum contamination in the soils. The bio-venting system resulted in reduced petroleum concentration, but not in all areas. The project was completed in 2006 when the remediation system was removed. It is anticipated that petroleum concentrations will continue to trend downward.

Herbicides are used for nonnative vegetation removal on SEFI. Glyphosate (four percent solution) and sethoxydim (one percent solution) are used for controlling New Zealand spinach, cheeseweed, and various grasses. These herbicides are stored in approved locked and spill-resistant pesticide storage containers.

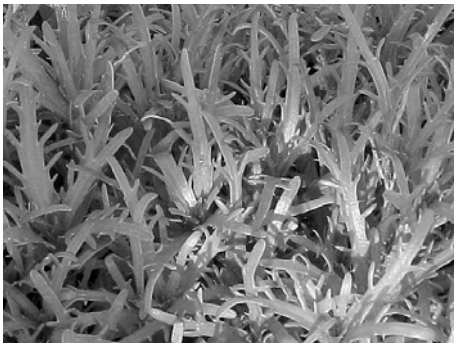
Between 1946 and 1970, nearly 50,000 drums of hazardous and radioactive wastes were dumped over a 350 square nautical mile area that overlaps the GFNMS. However, precise locations of these drums are unknown, with only 15 percent of the potentially contaminated area mapped. The extent of contamination in the waters surrounding the Refuge is unknown (USGS 2003).

Biological Resources

Vegetation

The diversity of vegetation on the Farallon Islands is low due to poor soil development and the harsh marine climate. Plant species composition and cover have been quantitatively monitored along permanent transects and qualitatively assessed in plots approximately every three years on SEFI since 1968 (Coulter and Irwin 2005). The comprehensive plant list for all surveys combined comprises 90 species, but an average of only 40 species are regularly recorded during any given survey. This is because many of the occurrences were of single or few plants of a nonnative species, which were then pulled to prevent establishment. Twenty-five native plant species appear on the plant list (Buffa 2005) (Appendix E).

Maritime goldfields, an annual species endemic to offshore seabird nesting islands in California, is the most abundant plant on SEFI. It thickly blankets the Marine Terrace and areas with soil development on the south- and north-facing slopes during the rainy season (early winter through spring). It grows more sparsely among the more rocky areas throughout the island, including West End. It produces a yellow composite inflorescence in the spring, and the entire plant dies back in response to the end of the rainy period. Dry stems blanket many parts of the island during most of the year and remain an important ecosystem component. Both the green and dried plant parts are used as nesting material by cormorants and gulls, and dried stems provide hiding cover for chicks. Sticky sandspurry (*Spergularia macrotheca*) and salt sandspurry (*S. marina*) are the other dominant native plants, found most commonly among rocks, on slopes, and where the soil is thin (Coulter 1972). Other native plants listed in Appendix E comprise only a minor component of the Farallon flora biomass.



Maritime goldfield
USFWS

Most of the nonnative plant species are found on the Marine Terrace and on the south- and southeast-facing slopes of Lighthouse Hill and Little Lighthouse Hill. New Zealand spinach, a dense mat-forming perennial, is a problem invasive weed. Since first being noticed as one small patch between the living quarters during Coulter's 1968 initial plant study, it has spread onto the Marine Terrace and up the slopes of Lighthouse and Little Lighthouse Hill (Coulter and Irwin 2005). Cheeseweed, a robust erect perennial first noted by Coulter in 1974, occurs primarily adjacent to paths, the water catchment, and helicopter pad, and in dense patches on the Marine Terrace. Both species displace native goldfields and make habitat less suitable for nesting seabirds. Weed management efforts (herbicide application and hand-pulling) are aimed at keeping New Zealand spinach and cheeseweed from growing in nesting areas during the breeding season and preventing their spread to other parts of the island.

New Zealand spinach patches
USFWS

Nonnative grasses—primarily ripgut brome (*Bromus diandrus*), foxtail barley (*Hordeum leporinum*), upright veldt grass (*Ehrharta erecta*), *Avena fatua*, *Cynodon dactylon*, *Festuca* sp., *Hordeum murinum* and cut-leaf plantain (*Plantago coronopus*) are also plants of concern because they are invasive, have the potential to displace native plants, and form dense mats that interfere with seabird nesting. They actively grow or cover habitat during the nesting season (when native plants are usually dormant) and tend to alter the habitat character from one of a barren nesting substrate to a habitat less suitable for nesting seabirds. Control of these species focuses primarily on keeping them from spreading to the north and west portions of the island and involves experimenting with a grass-specific sethoxydim-based herbicide (Poast) to reduce grass cover in key areas for burrow nesting seabirds.

The introduction of new nonnative plants to the island and the spread of the invasive species discussed above to the northern side of the island could pose a threat to native species. See Chapter 4, *Current Refuge Management and Programs*, for more details on vegetation management efforts.

Several individual California native trees—Monterey cypress (*Cupressus macrocarpa*) and Monterey pine (*Pinus radiata*)—were planted on the island prior to refuge acquisition, but only three trees survived the island's harsh conditions. These small, stunted trees and several small managed patches of tree mallow (*Lavatera arborea*) provide habitat for migrant landbirds during spring and fall. Though nonnative, they are not invasive and consequently are considered a beneficial habitat component rather than a threat to native species diversity.

Monterey pine on Southeast Farallon
USFWS

Several trends are apparent from recent vegetation surveys. Generally, plant species found in various areas have remained in those areas, although relative dominance among species has changed over the years (Coulter and Irwin 2005). There has been little advance of nonnative species to the north side of the island, perhaps in part due to the predominant north and northwest winds. In Coulter's Carpentry Shop study area, nonnative grasses have decreased since the 1970s, and maritime goldfields has increased. When monitoring studies began, nonnative grass cover was more than 50 percent and maritime goldfields cover was less than 10 percent. In 2005, maritime goldfield cover was more than 60 percent and nonnative grasses less than 10 percent (Buffa pers. obs.). An opposite trend is apparent in the Cart Path study area, which shows decreased cover of maritime goldfields and a concomitant increase in nonnative cheeseweed since 1991. Nonnative grasses on the Marine Terrace have not increased (Coulter 1995); however, the footprint of grasses has expanded on the south- and southeast-facing slopes of Lighthouse Hill (Buffa, personal obs.). Cut-leaf plantain has spread dramatically since two plants were first reported on the top of Lighthouse Hill in 1972, to the extent that it now covers much of the Marine Terrace and south-facing slopes of Lighthouse Hill (Coulter and Irwin 2005). Cut-leaf plantain has small seeds that are spread by wind; this characteristic could explain why the species has not become significantly established on Little Lighthouse Hill, which is upwind of the prevailing winds (Buffa, pers. obs.).

Wildlife

The Farallon Islands are an extremely important breeding site for seabirds and pinnipeds. Historically, it is estimated that several hundred thousand birds and pinnipeds relied on the Farallon Islands prior to human occupation. These numbers sharply declined in the 1800s due to egg collecting, commercial hunting, environmental contaminants, commercial fisheries interactions and oil spills. Hoary bats, salamanders, and insects are also present on the Refuge.

The Refuge supports 29 percent of the breeding seabird population in California and is the single largest seabird breeding colony in the contiguous 48 United States. A statewide survey of seabird colonies conducted by the Service in 1989–1991 found that the North Farallons and SFI colonies supported the largest seabird population in California, totaling 155,550 breeding birds of 12 species (plus another possibly breeding species). Breeding birds have increased to an estimated 335,000 since that survey. Five pinniped species haul out or breed on the Refuge. In addition, Guadalupe fur seals are occasionally recorded around the Farallon Islands. Maps of wildlife nesting, breeding, pupping, and haul-out sites have been developed to illustrate their locations on the Refuge in Appendix B.

South Farallon Island: Breeding Birds

Seabird monitoring and research is a prominent activity on the Refuge. Population size and/or breeding success for 12 of the 13 seabird species are monitored annually on SFI by PRBO. These species are common murre; tufted puffin; rhinoceros auklet; Cassin's auklet; pigeon guillemot; Brandt's, double-crested, and pelagic cormorants, black oystercatcher; western gull; and Ashy storm-petrel. Leach's storm-petrels also breed on the Refuge, but they are difficult to monitor and their population size has not been estimated. Rocky habitats provide nesting areas for many seabird species including common murre, pigeon guillemot, Brandt's cormorant, and tufted puffin. Soils provide habitat for burrow-nesting species such as Cassin's and rhinoceros auklets. The Refuge supports significant proportions of the state's breeding population of 10 species: Leach's storm petrel (11%), Ashy storm-petrel (55%), double crested cormorant (11%), Brandt's cormorant (25%), western gull (36%), common murre (35–45%), pigeon guillemot (12%), Cassin's auklet (68%), rhinoceros auklet (29%), and tufted puffin (25%). The Refuge hosts the world's largest colonies of Ashy storm-petrel, Brandt's cormorant, and western gull, as well as one of the southernmost rhinoceros auklet and tufted puffin colonies of significant size on the West Coast (Buffa 2005).

Seabird breeding activities on the Refuge are correlated with the seasonal occurrence of oceanic upwelling off central California. Extended periods of strong northwesterly winds during late winter and early spring promote the upwelling of cold, nutrient-rich subsurface waters. Upwelling stimulates phytoplankton blooms and production of zooplankton and juvenile fish, which are the prey base for the seabirds of the Refuge. Anchovy and juvenile rockfish are key forage species that are closely linked to seabird productivity, especially those of pelagic cormorant and pigeon guillemot, both of which forage close to the Refuge. Krill make up the entire diet of Cassin's auklets.

When upwelling occurs during the breeding season, seabird reproductive performance responds favorably. Such a correlation was documented between 1999 and 2004, when there was a steady upward trend for most species. During 2004, breeding populations of all species (except western gull) numbered well above the 10-year average (Warzybok et al. 2005). In 2005, sea surface temperatures were warmer than average in the early part of the breeding season, and breeding populations of most seabird species were lower than the 10-year average (Warzybok et al. 2005).

The breeding populations of Farallon seabirds during 2006 were larger than in 2005, with the exception of Cassin's auklet and Pigeon guillemot, which declined (Warzybok et al. 2006). Despite increases in population size between 1999 and 2004, the Cassin's auklet population still remains one-third less than the 1972 population estimate; this appears to be the result of the 1997–1998 El Niño event and poor ocean conditions in 2005 and 2006 (Warzybok et al. 2006). Common murres exhibited population growth due to the influx of young birds, but many of these are not yet of breeding age. The 2006 population estimate, the highest since surveys began in 1971, represents a four-fold increase since 2000 (Warzybok et al. 2006). Following a two-decade decline, Brandt's cormorant and pelagic cormorant populations have increased since 1999 (Warzybok et al. 2006).

2006 was a poor reproductive year for most seabird species due to warm sea surface temperatures in April and June and a lack of cold water upwelling, resulting in poor ocean productivity during the early part of the breeding season (Table 1) (Warzybok et al. 2006). All species except Brandt's cormorant and western gull experienced low reproductive success relative to long-term mean productivity. Pelagic cormorant and Cassin's auklet experienced near total reproductive failure for the second consecutive year. It is surmised that because pelagic cormorants and Cassin's auklets forage locally, the poor ocean conditions limited food availability (particularly krill), prevented both species from breeding successfully in 2006. Rhinoceros auklet, pigeon guillemot, and common murre had reduced productivity compared to 2005. Lack of strong northwest winds resulted in reduced replenishment of nutrients to surface waters, reducing prey availability. Juvenile rockfish were virtually absent from chick diets. Large anchovies were the predominant prey in the diet of murres and rhinoceros auklets, and sculpins comprised the majority of the pigeon guillemot diet (Warzybok et al. 2006). However, the large anchovies were too big for small common murre chicks to eat, possibly accounting for high chick mortality in that species (Warzybok et al. 2006).

Table 1. 2006 Seabird Productivity

Species	*Productivity (chicks fledged per pair)*	*Trends*
Ashy storm-petrel	0.46	17% below 2005; 32% below long-term mean; considered low productivity
Leach's storm-petrel	Not available	
Double-crested cormorant	Not available	
Brandt's cormorant	2.05	6% above 2005; 40% above 35-year mean
Pelagic cormorant	0.09	
Western gull	1.07	30% above 2005; equal to long-term mean
Black oystercatcher	0.67	Lowest productivity over the last several years
Common murre	0.39 (Upper Shubrick Point located on SFI) 0.65 (Upper Upper located on SFI)	USP: 22 % below 2005; 47% below 35-year average of 0.74; lowest observed since 1998 UU: 86% above 2005
Pigeon guillemot	0.22	48% below 2005; 74% below 35-year average
Tufted puffin	Not available	
Rhinoceros auklet	0.42	27% above 2005; 25% below 20-year average
Cassin's auklet	0	

USP: Upper Shubrick Point; UU: Upper Upper. (*Source: Warzybok et al. 2006*)

A Pacific Region Seabird Conservation Plan published by the Service describes current threats, management goals, and detailed information regarding seabirds. Major threats to seabirds include are listed below.

- Commercial and recreational fisheries.
- Introduced and nonnative species.
- Oil pollution.
- Other contaminants and hazardous substances.
- Plastic materials pollution.
- Disease.
- Habitat loss and disturbance.
- Climate change.

The seabird conservation plan summarizes the varying global population status and trends for the 11 of the 12 nesting seabird species, which are described for individual species below. Table 2 summarizes breeding population estimates over a ten-year period from 1996-2006. It is important to note that all these species were affected by the El Niño–Southern Oscillation events that occurred in 1982–1983, 1992, and 1997–1998. El Niño events reduce prey availability, with resulting implications for future population estimates.

Table 2. South Farallon Island Seabird Breeding Population

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	1996-2006
Species												Avg. Breeding Pop.
Ashy storm-petrel	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	2,661[3]	N/A
Double-crested cormorant	444	188[5]	330	468	402	402	486	392	458	130	474	377
Brandt's cormorant	8,074	7,490[4]	5,092[4]	6,345[4]	5,896[4]	6,570	9,466	11,222	16,754	11,732	15,692	9,485
Pelagic cormorant	374[4]	316[4]	164[4]	222[4]	260[4]	416	442	510	706	28	40	316
Black oystercatcher	12	22	18	30	26	30	22	26	26	30	36	25
Western gull	20,815	23,807	19,707	19,767	15,544	18,235	15,095	16,838	17,969	16,547	17,399	18,339
Pigeon guillemot	728	1,273	294	468	568	502	499	500[5]	1,096[6]	1,372[6]	2,607[6]	901
Common murre	65,400	61,089	52,670	58,878	53,301	68,194	103,588	107,105	169,079	183,092	211,355	103,068
Cassin's auklet	23,668	26,892	10,458	15,239	15,239	16,690	18,807	23,692	29,229	16,202	13,597	19,065
Rhinoceros auklet	±1000[7]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tufted puffin	92	130	50	118	74	102	128	N/A	190	50	60	99

(1) Farallon National Wildlife Refuge contains the world's largest breeding colony for species.
(2) Estimates from SEFI only.
(3) 1992 Estimate (Sydeman et al 1998). More recent population estimate are not available.
(4) Population estimate from land based survey only. No boat survey conducted.
(5) Pigeon guillemot data from evening raft counts. Using morning raft counts, population estimate = 2,383 & young fledged= 1,096
(6) Morning raft counts.
(7) Estimates are very rough.

Ashy Storm-Petrel. Ashy storm-petrel is currently a candidate for listing under the Endangered Species Act (ESA) and is a California Species of Special Concern (Shuford and Gardali 2008).

Birds listed in the *Birds of Conservation* Concern are species that, without additional conservation actions, are likely to become candidates for listing under the ESA. Ashy storm-petrel has an estimated world population of approximately 6,000–10,000 breeding birds (Ainley 1995). Because this species is predominantly pelagic, nocturnal, and a cryptic cavity nester, many aspects of its natural history are poorly documented. The largest breeding colony is located on the Farallon Islands, comprising 50 percent of the total population (Sydeman et al. 1998a). The oldest available population estimates indicate that the Farallons hosted 1,600–4,000 individuals (Ainley et al. 1974).

Ashy Storm Petrel Chick
© Jesse Irwin

However, the breeding population on the Farallon Islands declined a reported 35–40 percent between 1972 and 1992, in part as a result of adult predation by western gulls and owls (Sydeman et al. 1998). The high mouse population in fall entices some migrating burrowing owls to overwinter on the island. When the mouse population crashes, starving owls resort to storm-petrels as a food source (Mills 2004). A PRBO study estimated the breeding population of Ashy storm-petrel on SEFI at 2,661 individuals in 1992 (Sydeman et al. 1998); however, it is difficult to monitor this species because it is a cryptic cavity nester. Recent analyses indicate a slow increase in survival and abundance (mist net catch per unit effort) over the past decade (PRBO unpublished data). Productivity continues to be low: 32 percent below the long-term average productivity (Warzybok et al. 2006).

Double-Crested Cormorant. There are five subspecies of double-crested cormorant. This species was historically reduced by reproductive failure associated with DDT, human destruction of nests, and shooting (Hatch and Weseloh 1999). A current conservative estimate of the total population of double-crested cormorants in the U.S. and Canada exceeds 1 million birds, including breeding and non-breeding individuals; the population is probably closer to 2 million (Tyson et al. 1999). Carter et al. (1995a) documented recent increases in California and Oregon. Censuses of coastal colonies in California, Oregon, and Washington during 2001–2003 found 25,600 pairs, compared to 12,200 pairs found in the 1989–1991 censuses (Carter et al. 1995b). The population on the Farallon Islands, located on Maintop on West End, is much smaller than those at other breeding locations in California. The earliest estimates indicated that there were almost 50 breeding pairs on Maintop on West End in 1972 (Ainley and Boekelheide 1990). The small numbers were partly a result of the Pacific sardine decimation in the 1940s and 1950s by commercial overfishing. However, the Farallon colony is an order of magnitude smaller than it was in the mid-nineteenth century (Capitolo et al. 2004). Counts in 2006 indicated a breeding population of 474 birds, 265

percent higher than 2005, and 21 percent above the 10-year average (Warzybok et al. 2006). Due to poor visibility of nesting areas, no reproductive data are collected for this species.

Brandt's Cormorant. Brandt's cormorant has a global breeding population of fewer than 100,000. The majority (75 percent) of the breeding population is located in Oregon and California (Capitolo et al. 2004). Brandt's is the most abundant cormorant species on the Farallons. These birds are rarely found more than a few hours flight from land; because their feathers lack the waterproof characteristics of some other species, cormorants require land to preen and dry their feathers. The Service and Humboldt State University conducted a survey of all coastal Brandt's and double-crested cormorant colonies in 2003, and compared the results to those of 1979–1980 and 1989 surveys (Capitolo et al. 2006). This survey found that the central California Brandt's population was 38 percent larger in 1989 than in 1979–1980, suggesting growth concurrent with a decline at SFI. Nevertheless, the Farallon colony remains the largest in the world, comprising 25 percent of California's breeding birds.

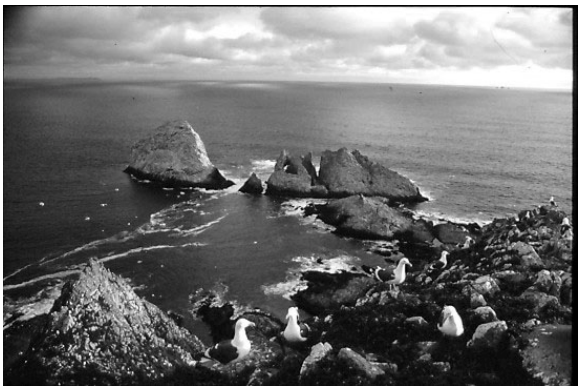
The Farallon Islands breeding population was estimated at 23,800 breeding birds in 1974. It exhibited a declining trend between the mid-1970s and 1990 as discussed above, with a low of 2,000 breeding birds in 1983 (Boekelheide et al. 1990b). During this time, there was a concomitant increase at other colonies along the central California coast and the Channel Islands (Carter et al. 1995c; Warzybok et al. 2002). Since 1990, the breeding population on the Farallons has trended upward. The Refuge population has grown substantially since 2000 due to survival and recruitment of young to the colony. Captitolo et al. (2006) estimated the 2004 Refuge population (including the North Farallons and SFI) at 17,116 birds. Population surveys in 2006 estimated 15,692 breeding birds—34 percent above the 2005 estimate and 77 percent above the 10-year average. Brandt's cormorant productivity in 2006 was 2.05 fledglings per pair, approximately 6 percent more than in 2005 and approximately 40 percent above the 35-year mean average (Warzybok et al. 2006).

Pelagic Cormorant. Pelagic cormorant has an estimated global population of 400,000 breeding birds and is considered stable (Hobson 1997). Sixty-nine thousand of these birds are in North America, of which 14,300 breed in California (Speich and Wahl 1989; Carter et al. 1992; Carter et al 1995c;; Kushlan et al. 2002). An estimated 550 pairs of these cliff-nesting birds were reported on SFI in 1972; this number peaked at almost 1,000 pairs in 1981 (Ainley and Boekelheide 1990). Pelagic cormorants declined substantially during the 1980s and 1990s, but like many other species on the Farallons, their population grew considerably between 1999 and 2004. In 2004, the breeding population was estimated at 706 individuals. The growth trend reversed in 2005, when the population estimate was 95 percent lower than in 2004. In 2006, there ware an estimated 40 breeding birds—42 percent more than in 2005, but 88 percent below the 10-year average (Warzybok et al. 2006). However, of the 20 nests, only one chick was confirmed to have hatched.

Western Gull. There are 80,000–126,000 breeding western gulls in the world (Sowls et al. 1980; Martin and Sydeman 1998). Approximately 50–57 percent of the population is located in California, with the largest single colony on SFI (Carter et al. 1992; Kushlan et al. 2002; Warzybok et al. 2002). This species is increasing in population due to increases in food availability from refuse dumps (Pierotti and Annett 1995). Landfills have closed since1995, resulting in less food availability. The greatest increases have occurred in San Francisco Bay and the Channel Islands (Carter et al. 1992). Historical records estimated 20,000 gulls on the Farallons in the 1800s (Heermann 1859). Population numbers are somewhat lower from those observed in the 1980s and early 1990s on the Farallons, but have been slowly increasing over the past few seasons. Counts from 1959 to 1990 ranged from 22,000 to 25,500 breeding birds on the Refuge (Ainley and

Boekelheide 1990). The 2006 breeding population at SEFI was estimated at 17,399 birds, 5 percent higher than in 2005, but 6 percent below the 10-year average.

California Gull. The overall California gull population estimate was 500,000-1,000,000 individuals during the early 1990s (Winkler 1996). California gulls began breeding in coastal California in 1981 and the colony complex in San Francisco Bay is now one of the largest in the U.S. Approximately 9,500 nests (19,000 breeders) bred at five sites in 2002 (C. Strong, pers. comm.). Population size at the San Francisco colonies continues to increase. In 2008, California gulls were observed breeding at the Farallons for the first time (PRBO, unpub. report). Large groups were seen milling on the Marine Terrace and eggs were confirmed at Sea Pigeon Point. There are two main breeding areas- Mirounga Beach and Sea Pigeon Point. 600 birds and 250 California gull nests were counted this year. However, breeding success remains uncertain due to large concentrations of the more aggressive western gulls in the same area.



Gulls-eye view of West End

Pigeon Guillemot. Pigeon guillemot has a global population of approximately 246,000, with 88,000 in North America (Ewins et al. 1993; Evenson et al. 2002; Kushlan et al. 2002). The Farallon Islands supports one of the largest breeding concentrations in the eastern Pacific (Ewins 1993; Warzybok et al. 2002). This species is a cavity nester, presenting challenges to accurate population surveys, but it is estimated that 15,500 birds are located in California (Carter et al. 1992).

PRBO's population monitoring indicates that pigeon guillemot populations may be recovering following a long-term declining trend. Between 1972 and 1982, the breeding population remained fairly stable at approximately 2,000 individuals. Between 1982 and 1997 the population fluctuated widely from year to year but generally stayed between 1,000 and 1,500 individuals. From 1998 to 2003, breeding population size estimates never exceeded 500 birds. From 2004 to 2006 the breeding population size was back up to 1,000 to 1,200. Population trends on the Farallons are difficult to assess because they are cavity nesters, and because the traditional protocol for estimating population size has been revisited recently. PRBO traditionally estimated breeding populations by counting the number of adults rafting on the water around dusk through the month of April and using the peak number as the population estimate. However, in recent years it was noticed that were more rafting birds in the mornings than the evenings. Morning counts were instituted in 2002. The peak morning count of 2,607 pigeon guillemots in 2006 was 335 percent higher than the peak dusk count of 777 birds. It was also approximately 90 percent higher than the peak count from 2005, and 20 percent higher than the 5-year average.

Pigeon guillemot
USFWS

In 2006, pigeon guillemots were monitored at Lighthouse Hill, Garbage Gulch, and the Habitat Sculpture, of which 79 were observed with at least one egg (56 percent of total monitored sites). Two nests were located in the habitat sculpture. Productivity was 0.23 fledglings per pair, 48 percent lower than last season and approximately 74 percent below the 35-year average (Warzybok et al. 2006).

Common Murre. Common murre has a global population of 4.3 million (Kushlan et al. 2002). Common murre is the most abundant breeding seabird in northern and central California. Murre populations in central California were severely depleted during the late 1800s and early 1900s by egging, human occupation/disturbance, and pollution (Manuwal et al. 2001). They began to recover during the twentieth century following protection of their nesting colonies. However, another dramatic decline of common murres at all central California colonies occurred during the 1980s, due largely to mortality from gill net fishing and oil spills (Takekawa et al. 1990), as well as reduced productivity related to the severe 1982–83 El Niño event (Carter et al. 2001). The statewide breeding population was estimated at 514,900 in 1982 and 351,600 in 1989 (Carter et al. 2001). Murre populations slowly began to recover following gill net restrictions in 1987 and better prevention/response to oil spills, and recovered more dramatically between 2001 and 2004. The most recent statewide estimate (from 2004) put the breeding population at 622,900 individuals, or 311,450 pairs (Capitolo et al. 2006), of which 32 percent (199,310 individuals) bred on the North Farallons and SFI.

Population trends on the Farallon Islands, thought to be the largest colony in all of California, Oregon, Washington, and British Columbia, mirror the statewide trends. Historical estimates for the Farallon common murre population range from 400,000 (Ainley et al. 1974) to several million individuals (Manuwal et al. 2001). Commercial egging began in 1849; from 1850 to 1892, between 180,000 and 600,000 eggs were harvested annually (Manuwal et al. 2001). By 1911, only 20,000 murres remained (Ainley and Boekelheide 1990). The population continued to decline due to oil spills and human occupation of SFI, causing habitat changes and disturbance from island personnel, children, dogs, cats, and livestock (Manuwal et al. 2001). In 1959, the population reached a low of 6,000 birds (Ainley and Boekelheide 1990). After the inclusion of SFI and neighboring islets in the Refuge in 1969, the human population on the island and other disturbance factors were reduced. The murre breeding population on the Farallons increased from an estimated 20,500 in 1972 (Ainley and Lewis 1974) to a peak of 102,000 in 1982 (USFWS unpubl. data). The population declined following the 1982–83 El Niño event, and remained depleted until the early 1990s, when slow population growth began to occur.

More recently, favorable oceanographic conditions, abundant prey, and protection from human-caused mortality have led to relatively strong reproductive success and high population growth—an average of 24 percent per year between 1999 and 2004 (Warzybok et al. 2006). The 2006 murre breeding population was estimated at between 282,500 and 300,000 individuals. This estimate is derived from PRBO's 2006 SFI estimate of 211,355 breeding adults and a Service estimate of 71,000–85,000 breeding birds on the North Farallons based on aerial counts (McChesney et al. 2006).

Cassin's Auklet. Cassin's auklet is designated by the Service as a Bird of Conservation Concern and is a California Species of Special Concern. There are two subspecies: one occurs only in Baja California; the other comprises the balance of the species' distribution (Van Rossem 1939; Gaston and Jones 1998). The species has a global breeding population of 3.6 million, with the core population occurring in British Columbia (Manuwal and Thorenson 1993; Kushlan et al. 2002). Only a small percentage of the world population (50,600) occurs in California; the 10-year average breeding population size on SEFI is approximately 20,000 (Warzybok et al. 2006). The estimate of the SEFI breeding population is considered to be very rough and is based on counts of burrows and crevice nesting sites. Population censuses and identification of nesting locations 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 SFI, conducted by the Service in 1989, produced an estimate of 29,880 breeding birds on SEFI (38,274 for all SFI). A burrow occupancy rate of 75 percent was used as a correction factor. Since 1991, PRBO has monitored Cassin's auklet burrows and crevices in twelve index plots on SEFI to identify population trends. The difference in index plot burrow density each year is applied to the 1989 Service population estimate to roughly estimate the current year's population.

Cassin's Auklet
© Duncan Wright

Following a dramatic upward trend in population size between 1999 and 2004, the 2006 SEFI breeding population declined to an estimated 13,597 birds—16 percent fewer than in 2005 and 31 percent below than the 10-year average. Annual survival of adults at the Farallon Islands has been estimated at 67–70 percent, a rate too low to sustain the population in view of other life history parameters (Nur et al. 1998; Bertram et al. 2000). Survival on the Farallon Islands has also been affected by the presence of house mice and potentially by barn owl predation of eggs and small chicks (Mills 2004).

2006 occupancy of monitored nesting boxes was 84 percent, contrasted with 36 percent in 2005 (Warzybok et al. 2006). However, for the second straight year, auklets breeding in the nesting boxes suffered complete reproductive failure (Warzybok et al. 2006). The reason for this complete reproductive failure appears to be oceanographic conditions, which led to a massive reduction in the availability of krill, the auklets' primary prey, for most of the spring and summer. Oceanographic conditions continued to be the poorest observed since the 1998 El Niño even, resulting in delayed breeding, mass abandonment of breeding attempts, reduced hatching and fledging success, and high chick mortality.

Rhinoceros Auklet. Also known as horn-billed puffin, rhinoceros auklet is a California Species of Special Concern. It has a global breeding population of 1.5 million, of which one million are in the North American segment, primarily in British Columbia (Gaston and Dechesne 1996). An estimated 2,000 individuals breed in California (Carter et al. 1992). The species was extirpated from California circa 1860, but over the last 30–40 years the population has expanded to its historic range. This species did not return to SFI until 1972, after rabbits were eradicated (Ainley and Boekelheide 1990). The Farallon population has shown diminishing reproductive performance since 1986, but this decline has not been deemed significant (Sydeman et al. 2001). No population size estimates on SEFI are available due to difficulties in monitoring this burrowing species. Rhinoceros auklet pairs bred in 51 percent of 151 monitored sites (boxes, crevices, and cave sites) during 2006. Auklets produced 0.42 fledglings per pair in 2006, 27 percent more than the previous year, but 25 percent below the 20-year average (Warzybok et al. 2006).

Rhinoceros auklet burrows
USFWS

Tufted Puffin. Tufted puffin is a California Species of Special Concern. It has a global breeding population of approximately 3 million (Piatt and Kitaysky 2002); while this is generally considered an accurate estimate, population numbers and productivity are difficult to assess for this crevice-nesting seabird. The species is declining in California, Oregon, and Washington ranging anywhere from a 3 to 21 percent decline (Piatt and Kitaysky 2002). Eighty-two percent of

breeding birds are found in North America; only 1 percent of this population breeds in the Service's Pacific Region.

The Farallons lie at the southern extreme of the breeding range. Tufted puffins were much more numerous in the nineteenth century, when breeding populations in the Farallons were estimated in the thousands (Ainley and Boekelhide 1990). The trend since 1992 has been stable to slightly increasing; the Refuge population has generally numbered between 60 and 100 breeding individuals. The 2006 estimate of 60 breeding birds constitutes a 20 percent increase over 2005 (Warzybok et al. 2006). Population size is based on the number of occupied breeding sites observed during two 1-week periods (mid-May and early August). Productivity cannot be estimated due to the inaccessibility of nesting crevices.

Tufted puffin
© Jesse Irwin

Leach's Storm-Petrel. Leach's storm-petrel has an estimated global population of more than 16 million. However, population estimates and locations of nesting sites are uncertain due to the species' nocturnal and cavity-nesting habits (Carter et al. 1992; Kushlan et al. 2002). There are an estimated 12,500 breeding birds in California (Carter et al. 1992). Population trends for this species are unknown. Habitat degradation has been a factor in the decline of some California colonies. There are no current population estimates for Leach's storm petrel on the Refuge. Leach's and Ashy storm-petrels are mistnetted and banded on SEFI as part of a mark/recapture study that began in 1992 (Warzybok et al. 2006). Data have not yet been analyzed or modeled to determine population size.

Black Oystercatcher. The black oystercatcher breeding population is estimated by censusing all known breeding sites visible from Lighthouse Hill and the Marine Terrace. The estimate does not account for birds on parts of West End that are not visible from the SFI vantage points. Of the 30 sites that were monitored during 2006, 18 were attended by breeding pairs with had eggs and/or chicks; it was estimated that eight chicks fledged (Warzybok et al. 2006). This estimate is 20 percent higher than that from 2005.

North Farallon Islands: Breeding Birds

Rocky slopes and ledges on the North Farallon Islands provide important nesting habitat for common murres and to a lesser extent, Brandt's cormorants. Breeding population estimates based on annual aerial surveys conducted by the Service during late May or early June are shown below.

Table 3. North Farallon Island Breeding Populations Estimates

Species/Year	2001	2002	2003	2004	2005
Common Murre	58,672	66,478	65,046	62,022	71,232
Brandt's Cormorant	N/A	196	196	102	40

The first and only recorded onsite biological investigation of North Farallon Islands was conducted by Service and U.S. Geological Survey personnel on 2 September 1994. The main objective was to determine the presence of breeding birds other than murres and Brandt's cormorants; crevice nesting birds and habitat were specifically targeted. East, South, and West Islands (also called "Isle of St James") were visited. No landing was made on the North Island due to the presence of hauled-out sea lions and poor sea conditions. Pigeon guillemots, Cassin's auklets, and pelagic cormorants were all confirmed as nesting (albeit in small numbers) on the North Farallons. No Ashy storm-petrels and very little potential nesting habitat (small crevices) were found, although the survey did not rule out the possibility of a small nesting population. Western gulls (including some hatching year birds) and one tufted puffin (flyby) were also documented during the investigation.

South Farallon Island: Non-Breeding Birds

PRBO has counted migratory and seasonally resident birds daily on SEFI since 1968. Birds are mistnetted and banded when weather conditions and work priorities allow obtaining more accurate counts. Non-breeding birds include terrestrial birds, raptors, and waterbirds. Numerous species of terrestrial birds migrate through the area. Some land on the island and stay for a matter of hours, days or, in fewer cases, an entire season. Species lists and numbers vary annually. More than 400 species have been recorded since 1968. During the fall season of 2005, a total of 224 species were observed, and 91 species were found during mistnetting. Appendix G lists the occurrence and seasonal distribution of birds on SEFI from 1968 to 1999.

Bird arrivals and departures are influenced by localized weather patterns. Pyle et al. (1993) found that more migrant birds arrive on SEFI during periods of low winds, low to moderate visibility, full cloud cover, and lack of fog. Migratory birds tend to depart during periods of low but rising barometric pressure, clear and clearing skies, high visibility, and decreased moonlight. Pyle et al. (1994) found that trends of migrant landbirds censused on SEFI from 1968 to 1992 concurred with population trends from Breeding Bird Survey data. This indicates that information on migrating birds collected on the Refuge has a relevancy to the assessment of bird populations at the flyway or continental scale.

One to four peregrine falcons are present throughout the winter, early spring, and fall months (January–April and September–December). They take Cassin's auklets and common murres at sea near SEFI, and are also observed hunting other landbirds (including burrowing owls) over the island. Peregrines also feed on pigeon guillemots and rhinoceros auklets in the spring, and even adult Western gulls in the winter (R. Bradley, pers. comm.). Take by peregrines is not thought to have a significant effect on the Western gull population.

Peregrine falcon
© Rick Heaslet

While burrowing owls do not breed on SEFI, migrants arrive in the fall. Most leave after a short time to seek higher-quality wintering habitat (like other migrant landbirds that pass through SEFI). A few, however, (two to five on average) stay to overwinter, attracted by the seasonally abundant house mice, whose population peaks in the fall. Most burrowing owls that overwinter turn to seabirds as a food source once the mouse population crashes in late winter and petrels return to stake out breeding sites. Although difficult to capture, several individual burrowing owls have been trapped and transported to the mainland recently in an effort to reduce predation on declining petrels and give the owls a better chance at survival. Most owls that overwinter on SEFI do not survive—they typically succumb to starvation or are predated by gulls or peregrines. Five burrowing owls have been translocated to more suitable habitat on Don Edwards San Francisco Bay NWR between 2005 and 2007: four at the Warm Springs unit and one at the Mayhews Landing location.

California brown pelicans are discussed later in *Federally Listed Species at the Refuge.*

Pinnipeds

Five species of marine mammals breed or haul-out on the Refuge: northern fur seal, Steller sea lion, California sea lion, harbor seal, and northern elephant seal. There are no accurate historical estimates available for most species. However, historic accounts suggest that pinnipeds numbered in the tens of thousands or more prior to human occupation. These species were once heavily hunted on the island by Americans and Russians in the early 1800s. Pinnipeds are surveyed weekly on SEFI. Populations of some pinniped species are increasing on the Refuge (Table 4). Individual species are discussed as follows.

Table 4. Maximum Population Numbers (peak monthly)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
California sea lion	4,303 (Aug)	4,990 (July)	7,837 (Oct)	5,270 (Jan)	2,423 (Sept)	3,301 (Aug)	4,480 (June)	5,630 (Feb)	5,292 (Jan)	4,412 (Sept)	10,529 (Jun)
Steller sea lion	213 (Nov)	148 (Nov)	253 (Dec)	133 (Oct)	174 (July)	261 (May)	304 (Nov)	373 (Mar)	149 (May)	202 (Apr)	170 (Apr)
Harbor seal	144 (Sep/Oct)	141 (Sept/Nov)	190 (Feb)	125 (Feb)	128 (Dec)	150 (Dec)	168 (Jan)	180 (Jan)	166 (Jul)	136 (Jun)	114 (Mar)
Northern elephant seal	590 (Jan)	571 (Nov)	406 (Jan)	623 (Nov)	1,019 (Nov)	843 (Oct)	736 (Nov)	1,009 (Nov)	594 (Apr)	568 (Apr)	559 (Oct)
Northern fur seal	10 (Aug-Oct)	8–12 (Sept)	4 (Nov)	22 (Aug)	13 (Sept)	18 (Sept)	35 (Sept)	22 (Sept)	38 (Sept)	90 (Aug)	188 (Aug)

Northern elephant seal. Northern elephant seals breed and give birth in California and Baja California, primarily on offshore islands (Stewart et al. 1994). The California breeding stock was estimated at 127,000 in 1991 (Stewart et al. 1994) and declined to an estimated 101,000 in 2001 (Carretta et al. 2002). Seals that breed on the Farallon Islands are from the California breeding stock. Once hunted to extirpation by the late 1800s, northern elephant seals recolonized as a breeding species on SEFI in 1972. They increased at an average rate of 56.5 percent annually between 1973 and 1983 (Sydeman and Allen 1999), when they apparently reached carrying capacity. Between 1983 and 2000 the number of pups declined an average 3.5 percent annually (Buffa 2005). Since 2000, however, the numbers of cows, pups, and weaners have been stable to slightly increasing. The cows currently give birth primarily at Sand Flat and Mirounga Beach on SEFI. Elephant seals have also recolonized on West End. The population of breeding cows since 2001 averages approximately 170. Productivity (weaners/cow) on SEFI for 2006 was slightly below the 14-year average. Combined SEFI and West End totals for the 2005–2006 season indicate that 203 cows successfully weaned 132 pups (Lee 2006).

Elephant Seal Bull with Pup

Northern fur seal. Like elephant seals, northern fur seals were also extirpated from the Farallons as a result of the intense hunting pressure to which they were subjected. This species was the dominant pinniped on the Farallon Islands at the time of human arrival, with breeding colonies numbering in the tens of thousands covering the Marine Terrace. In 1996, the first fur seal pup in

more than 150 years was recorded on the Farallon Islands. Until this historic birth, northern fur seals were only known to breed in Alaska and the Channel Islands. Since then, births have slowly increased (specifically on West End only), with rapid growth in recent years. Eight pups and 22 individuals were observed in 2003 (Buffa 2003). In 2006 188 animals, including 97 pups, were recorded. Many resights of tagged individuals suggest that fur seals on the Farallon Islands are from the San Miguel Island stock. The most recent stock assessment report in 2003 indicates that the minimum worldwide population estimate for this stock is 4,190 (Carretta et al. 2003). The stock is not currently listed as threatened or endangered.

Sleeping northern fur seal
© Adam Brown

California sea lion. The most recent stock assessment for California sea lions in 2003 indicated a minimum population size for this stock of 138,881 (Carretta et al. 2003). However, the entire population cannot be counted because all age and sex classes are never ashore at the same time. Three El Niño events from 1983 to 1998 have affected the population by reducing adult female survivorship. Pup and juvenile mortality associated with El Niño events has also affected the population.

California sea lions, primarily non-breeding subadults, haul-out on SFI year-round. They are the most abundant species of pinniped on the Refuge, although the Farallons are not a primary pupping area. Most California sea lion young in California are produced south of Point Conception, with the Farallons representing the northern breeding limit for the species. Prior to 1998, only a few pups were born on the Refuge each year, but pupping has increased since the 1998 El Niño event (ranging from one to several dozen per year since 1998). Like all pinnipeds on the Refuge, California sea lions that are resting on regularly-used haul-out areas are censused weekly year-round. Sea lion numbers increased at SFI at an average rate of 6.4 percent per year between 1973 and 1994. Peak California sea lion abundance on SFI was observed in the years of the 1983, 1992, and 1998 El Niño Southerly Oscillation events.

The peak count of 10,529 California sea lions as reported by PRBO in June 2006 (Table 4) was not associated with an El Niño event and remains unprecedented and unexplained. Average monthly California and Steller's sea lion numbers for SFI and North Farallon Island, based on PRBO's weekly pinniped surveys (See Appendix B for site locations) and the annual (mid-summer) aerial counts conducted by NMFS for the North Farallons are shown in Table 5.

Table 5. Sea Lion Counts: South Farallon and North Farallon Islands

Species/Year	2000	2001	2002	2003	2004	2005
CA Sea Lion – SFI Average Monthly	1,123	1,491	1,909	2,791	1,706	2,012
CA Sea Lion – NFI aerial summer count	42	2	92	292	95	N/A
Steller's Sea Lion – SFI Average Monthly	49	75	70	70	53	68
Steller's Sea Lion – NFI aerial summer count	1	2	13	55	37	N/A

A complete worldwide population count of harbor seals is not possible because adults do not haul-out at the same time. Pup counts are also difficult because pups often enter the water almost immediately after birth. Best estimates are based on the fraction of seals hauled out at any time during a 24-hour period. By this assessment method, the minimum size of the California harbor seal population is 25,720 (Carretta et al. 2003). This stock has shown rapid increase from 1972 to 1990. Since 1990, there has been no net population growth along the mainland or on the Channel Islands. The stock is not listed as endangered or threatened under the ESA.

Harbor seal. Harbor seals use SFI primarily as a haul-out site (See Appendix B for general locations), although a few pups are born each year. Harbor seal populations at SEFI grew at an annual rate of 10.4 percent between 1973 and 1994 (Buffa 2005). This trend is probably caused by poor food availability in their coastal foraging grounds, forcing them to search in pelagic waters near the Refuge (Buffa 2005).

Steller sea lions are discussed below in *Federally Listed Species at the Refuge*.

Federally Listed Species at the Refuge

Two federally listed species occur on the Refuge: Steller sea lion and California brown pelican. However, brown pelican is currently being reviewed for delisting.

Steller sea lion. Steller sea lion was listed under the ESA in 1990 due to a 50 percent worldwide decline between the 1960s and 1989. Two separate stocks of Steller sea lions are now recognized within U.S. waters: an eastern and a western stock. The western stock is listed as endangered; the eastern stock is listed as threatened. The eastern stock comprises animals that breed along the west coast of North America between California and southeast Alaska. Total population for the eastern stock, based on a rangewide 2002 survey, is estimated at 45,000–57,000 individuals (Pitcher et al. 2007).

The Refuge and surrounding waters are designated critical habitat for the threatened eastern stock of Steller sea lion. Most of the following discussion is based on a report from Hastings and Sydeman (2002). Counts of Steller sea lions on the Farallon Islands have been conducted since 1927; however, standardized annual counts on SFI have occurred only since 1973. The Steller sea lion population has declined on SEFI 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 Refuge has declined approximately 80 percent, from an average of 790 animals during 1927–1947 to an average of 150 animals during 1974–1996. Average monthly counts for 2000 to 2005 are shown in Table 5.

Steller sea lion
© Malcolm Coulter

Steller sea lions breed in small numbers from May through August. Between 1974 and 1996, numbers of adult females during the breeding season declined approximately 6 percent per year; maximum pup counts also declined significantly. Twenty to thirty pups were born annually in the late 1970s and early 1980s, compared with an average of 10 per year between 1996 and 2005. Shell Beach and Indian Head on West End are currently the only active rookery sites on SFI (See Appendix B, SFI Steller Sea Lion Sites). Mother/pup pairs also move in the fall from breeding sites on Año Nuevo to haul-out on the Farallon Islands.

Possible reasons for the SFI Steller sea lion population decline include pollution, human disturbance, overfishing, increased disease and/or predation, and El Niño effects. PRBO's annual monitoring suggests that the 1982–83 El Niño event 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 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.

California brown pelican. California brown pelican is federally listed as endangered, but are in the process of being delisted. Brown pelicans disperse from breeding sites in southern California and Baja California to roost on and feed from the Farallon Islands. Hundreds and sometimes thousands of pelicans drape West End and other roosting areas from late summer through fall. Brown pelican numbers peaked during 2006 at more than 3,000 in August and September. Peak numbers usually occur in September or October, 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 are present during warm-water years) and the relative abundance of food resources in coastal and offshore zones. The high numbers observed during the early part of 2005 may be due to the exceptionally high numbers that nested on Anacapa Island during the 2004 breeding season. During late 2004 and early 2005, high numbers of wintering pelicans and birds in unusual places were reported at other areas along the coast, including Humboldt Bay (Buffa 2005).

California brown pelicans
© Malcolm Coulter

Other Wildlife

White shark. White sharks (*Carcharodon carcharias*) travel to the waters off the Refuge in the fall to feed on pinnipeds—primarily juvenile elephant seals and California sea lions. PRBO has studied white sharks in water surrounding SEFI from a vantage point on top of Lighthouse Hill since the early 1970s. The objectives of the study include determining the frequency of predatory attacks, determining the species and size/age composition of white shark prey, and resighting known individuals using scar patterns (Buffa 2005). Elephant seals are the most commonly taken prey, although California sea lions are also taken. A satellite tagging study (1999–2004) that tracked shark movements found that most sharks traveled to a region of the Pacific roughly halfway between Baja California and Hawaii after leaving the Gulf of the Farallones.

Great white shark feeding
© Rick Heaslet

Hoary bat. Hoary bats (*Lasiurus cinereus*) range throughout the Americas from northern Canada to Argentina and Chile (Hall 1981; Shump and Shump 1982a). Based on incidental observations on SEFI over the last three decade, they are also believed to overwinter in California (Cryan and Brown 2007). Tenaza (1966) first reported the occurrence of hoary bats on SEFI in fall 1965. Since then, PRBO biologists have recorded the presence of hoary bats on the island in 36 of the past 38 years. Migratory hoary bats occur on SEFI, generally during the fall (late August through October). Observations indicate that hoary bats were most frequent in September than any other month. Bats are usually observed roosting in trees or mallow near the houses, and occasionally in caves or ledges (Cryan and Brown 2007). In most parts of their range, males and females are segregated. Therefore, observations of both males and females on SEFI, including some copulations, have drawn the attention of bat researchers. SEFI is the only location in North America where tree bats can be observed with any regularity during migration

(Cryan and Brown 2007). Other bat species that have been observed less frequently on SEFI during migration include western red bats (*L. blossevillii*) and free-tailed bats (*Tadarida brasiliensis*).

Arboreal salamander. Arboreal salamanders (*Aneides lugubris farallonensis*) were first noted on the Farallon Islands by Boulenger (1882). The coloration of the Farallon subspecies is distinct from that of the mainland subspecies. Farallon salamanders are active at the surface during moist times of the year, but retreat into crevices and burrows during dry weather. A few short-term studies were conducted in the 1950s, 1960s, and 1970s (Anderson 1960, Boekelheide 1975). Estimates of population density have varied from 100-200 per acres (Anderson 1960) to 700 per acres (Boekelheide 1975). In 1974, Boekelheide area-searched along a transect from the Marine Terrace up to the lighthouse on SEFI and found the greatest densities on the talus slope above the residences and on the cliff below the lighthouse. There have been no multiyear studies to determine salamander population status and trends until late 2006, when the first-ever mark-capture study was conducted (Lee 2008, unpub. report). Since November 2006, a total of 251 salamanders were individually identified.

Arboreal salamander

Nonnative Wildlife

Feral rabbits, cats, working mules, and pet dogs were once present on the island. All these species have been removed. Rabbits and cats adversely affected seabird populations and reproduction. Mules were used to build trails and transport supplies on SEFI. House mice are still present and problematic. House mice followed the early human inhabitants onto SEFI and subsequently to West End (Ainley and Boekelheide 1990).

Cultural Resources

The numerous past human activities on the island resulted in many remnant elements that contributed to the listing of SEFI in the National Register of Historic Places (NRHP) in 1977. This designation did not specifically identify significant structures or other elements. Instead, structures and elements have been evaluated for their historic significance as activities that may affect them are planned. Several structures have been evaluated and are considered significant: the two residences, the carpenter's shop, the rail cart system, and the Lighthouse Hill trail and rock walls (Table 6).

The oldest remaining structure on the Refuge is thought to be the foundation of the Russian House, which was used for seal hunting. The residences and office building are thought to have been constructed circa 1880, while the rail cart system is believed to have been constructed around 1878 (Valentine 2000). The Russian House area has the highest recorded values of marine mammal bone on the island (Wake and Graesch 1999). Russian era shelters and eggers' barracks also contain a high frequency of surface artifacts and mid-nineteenth century bottle glass. The infamous Farallon egg wars were fought here (Wake and Graesch 1999). The stone enclosures and wall south of North Landing are also associated with significant egging history. These structures were used by eggers for cleaning and storing eggs (Wake and Graesch 1999). Sewer Gulch served as a dump site in the later part of the nineteenth century. Many archaeological deposits in this area help provide insight into early human activities on the island.

The historical housing was built to accommodate lighthouse crew, which were initially limited to men and later included families. The architect is unknown, but the houses are estimated to have been constructed in the late nineteenth century and are good examples of nineteenth century institutional architecture. These residences were extensively altered around 1959, losing the integrity of their original design, materials, and workmanship. Renovation of both houses in 2000 prevented further deterioration and restored them toward their original design. The two residences are considered culturally significant and are listed in the NRHP. These houses still serve as residences for Refuge staff, PRBO staff, and researchers. Rock features in front of one of the houses could potentially be a historical butchering area for preparation of marine mammals and other prey (Wake and Graesch 1999).

A limited amount of aboriginal artifacts are present on SEFI. Some artifacts are ascribed to Aleut or Northwest Coast origin, while others are associated with California Native Americans. Those items that were manufactured by Native Americans are thought to be associated with the Russian fur traders and their various Native American employees (Smith 1967). There is no documented evidence for prehistoric Native American settlement on the islands.

The foghorn remnants have not been evaluated and may retain some historical significance. In any case, the foghorn should be noted as the earliest attempt on the Farallons at providing a navigational warning. The lighthouse on SEFI has not been evaluated by the Service because no renovations that would warrant a cultural assessment of the structure have been made. During habitation by the lighthouse crew, the rail cart system on SEFI was an important vehicle for transporting goods from ships to the main structures. It was built to connect the North Landing with the residences and coal storage site. The line was later extended to the East Landing. The system carried coal and other freight from the landing to the residences by mule power; it was never motorized. The last mule was used in 1913; since then, carts have been powered by residents. This system is considered culturally significant because it represents a certain function during a historic period (1878–1939). The rail cart system between North Landing and the residences no longer exists, but the portion between East Landing and the residences is still used, although it has been somewhat modified.

The building known as the carpenter's shop was constructed by the Navy in 1905. The Navy station was occupied from 1905 until about 1945. The structure was evaluated in 2005 and found eligible for inclusion in the NRHP as a contribution to the Southeast Farallon Historic District. While the water catchment area is not considered culturally significant, the area surrounding it has a high potential for subsurface artifacts and features (Valentine 2000).

Water catchment infrastructure
USFWS

Table 6. Status of Potential Historical Elements on Southeast Island.

Element #	*Description*	*Construct Year*	*Facility Type*	*Status*
1	Loading Boom	1988	Other structures/facilities	Not evaluated
2	Residence Building	1879	Residences	Evaluated in 1998, contributing historical element
3	Office/Laboratory	1883	Office buildings	Evaluated in 1998, contributing historical element
4	Powerhouse	1940	Other buildings	Evaluated in 1998, not eligible
5	Lighthouse Hill Trail	1880	Service trails	Evaluated in 2007, contributing historical element
6	North Landing Storage Building	1915	Storage buildings	Not evaluated
7	Water Distribution Line	1960	Water distribution lines	Not evaluated
8	Water Catchment System	1900	Water treatment facilities	Evaluated in 1998, not eligible
9	Rail Cart System	1900	Other structures/facilities	Evaluated in 1998, contributing historical element
10	Old Structures (debris)	1940	Other structures/facilities	Not evaluated
11	Carpenter/Pipe Shop Building	1940	Shop/service buildings	Contributing historical element
12	North Landing Trail	1945	Service trails	Not evaluated
13	North Landing	1945	Piers	Evaluated in 2000, not eligible
14	Concrete Landing Pad	1955	Other structures/facilities	Evaluated in 1998, not eligible
15	Pump House	1960	Other buildings	Not evaluated
16	Water Storage Tanks	1945	Water treatment facilities	Not evaluated
17	Abandoned Water Pipe	1960	Water distribution lines	Not evaluated

Social and Economic Environment

The Refuge is approximately 28 miles west of San Francisco, which is the closest urban area. Due to its remote location, there is little social interaction or economic benefits that the Refuge can provide to the nearest community.

Demographics

Due to the remote location of this Refuge, no demography information was collected.

Land Use

There are several buildings on the Refuge including a fully automated lighthouse, two residences, storage buildings, water tanks, and a water catchment pad. Observation blinds have been built on the Refuge. There are boardwalk trails that have been constructed to protect wildlife habitat.

Common murre ledge and blind
USFWS

Traffic and Public Access

Public access is not allowed on the Refuge due to the sensitive nature of the wildlife and the difficulty in landing on SEFI. The rock cliffs surrounding the island require the use of a landing derrick to transport staff and supplies from the vessel to the island on an intermittent basis (every two weeks). This vessel traffic and associated activities have not been known to disturb wildlife because these activities are located away from primary nesting and roosting areas. Non-Refuge staff researchers that meet certain criteria are allowed on the island by Refuge Special Use Permit. In addition, there is some signage on the Refuge deterring boaters from coming too close to the islands.

Recreation

There are currently no recreation opportunities on the Refuge due to its remote location and sensitive wildlife. As described in Chapter 4, Current Refuge Management and Programs, a number of wildlife watching boats charter visits out to the waters surrounding the Refuge. A total of 84 sightseeing boats with an estimated 2,554 people on board were recorded during the 2004 season, and 79 boats with an estimated 2,023 people on board were recorded during 2005. These figures are below the 10-year average of 3,350 boat-tour visitors per year (USFWS, unpub. data). One concessionaire began offering shark cage diving in the waters off the Refuge in 2004, and there are now two to three concessionaires. Concessions operate 5 days a week from mid-September through mid-November, serving a total of 400 people on 40 trips (Buffa 2005).

Local Economy and Employment

The Refuge is within San Francisco County limits, but does not provide any employment opportunities due to its remote location. Access to the Refuge is strictly monitored and limited to Refuge staff, contractors, and Special Use Permit holders due to the sensitive nature of the wildlife. Indirectly, income is generated by wildlife viewing from charter boats touring the waters around SEFI. These boats are not directly associated with the Refuge through a concession or permit, but refuge staff does conduct some limited outreach activities with tour naturalists.

Environmental Justice

On February 11, 1994, the President issued Executive Order 12898 (*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*), which directs the U.S. Environmental Protection Agency (EPA) to ensure that agencies analyze environmental effects on minority and low-income communities. The purpose of the executive order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health impacts resulting from federal actions and policies on minority and low-income populations. The planned management activities are not expected to have any impact on these populations.

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Chapter 4. Current Refuge Management and Programs

Infrastructure on the Refuge can support a limited number of live-in staff who monitor wildlife and maintain the infrastructure year-round. Through a cooperative agreement, PRBO provides wildlife monitoring, resource protection, and day-to-day surveillance on the Refuge. Service staff manages the Farallons from the Complex office in Fremont and through regular visits to the Refuge.

Land Management

Of the four groups of islands included in the Farallon National Wildlife Refuge (SFI, Middle, North, and Noonday Rock), active management occurs only on SEFI. The other three groups of islands are difficult to access. Noonday Rock, the northernmost island in the Refuge, is subtidal, but the shallow water around it provides important habitat for fish and food for marine birds and mammals.

The Refuge, as originally established in 1909 by a presidential executive order, encompassed only 91 acres on Middle Farallon, the North Farallons, and Noonday Rock. SFI was excluded because USCG had jurisdiction there for navigation safety through an 1859 executive order. In 1969, SFI and associated islets were added to the Refuge by Public Land Order 4671, subordinate to USCG's administration for lighthouse purposes. Since 1969, USCG has gradually reduced its presence, and today its management consists primarily of accessing the island 2–3 times a year to maintain the navigational light and the solar power system that runs it. The Service manages all facilities, buildings (other than the lighthouse), habitat, use, and access.

A number of wildlife and habitat management activities are in place at the Refuge. Continual staff presence on the Refuge provides wildlife protection by documenting disturbance events and discouraging trespassers from landing on SEFI. However, because human activity can significantly disrupt wildlife, the Service and PRBO limit the number of staff residing at the field station to eight persons. A continuous and extensive data set has also been accumulated over several decades through staff presence.

Water Management

The Refuge relies entirely on rainwater for water. A concrete water catchment pad collects rainwater, which is directed into a 10,000 gallon settling tank. Particulates settle out of the water in this tank before the water is pumped into the main 160,000-gallon storage cistern. The water is pumped from the cistern uphill to a 10,000-gallon wooden tank about once a month. Water flows by gravity from the wooden tank to the residence and other facilities on the island on demand. Water receives multiple purification treatments—ozone, ultraviolet rays, nitrate filters, sediment filters, and micron filters—to make it potable. The Alameda County Water District tests Farallon water samples approximately four times per year for nitrate levels, bacterial counts, and presence of fecal coliform bacteria. Test results to date have been below thresholds of concern.

Vegetation Management

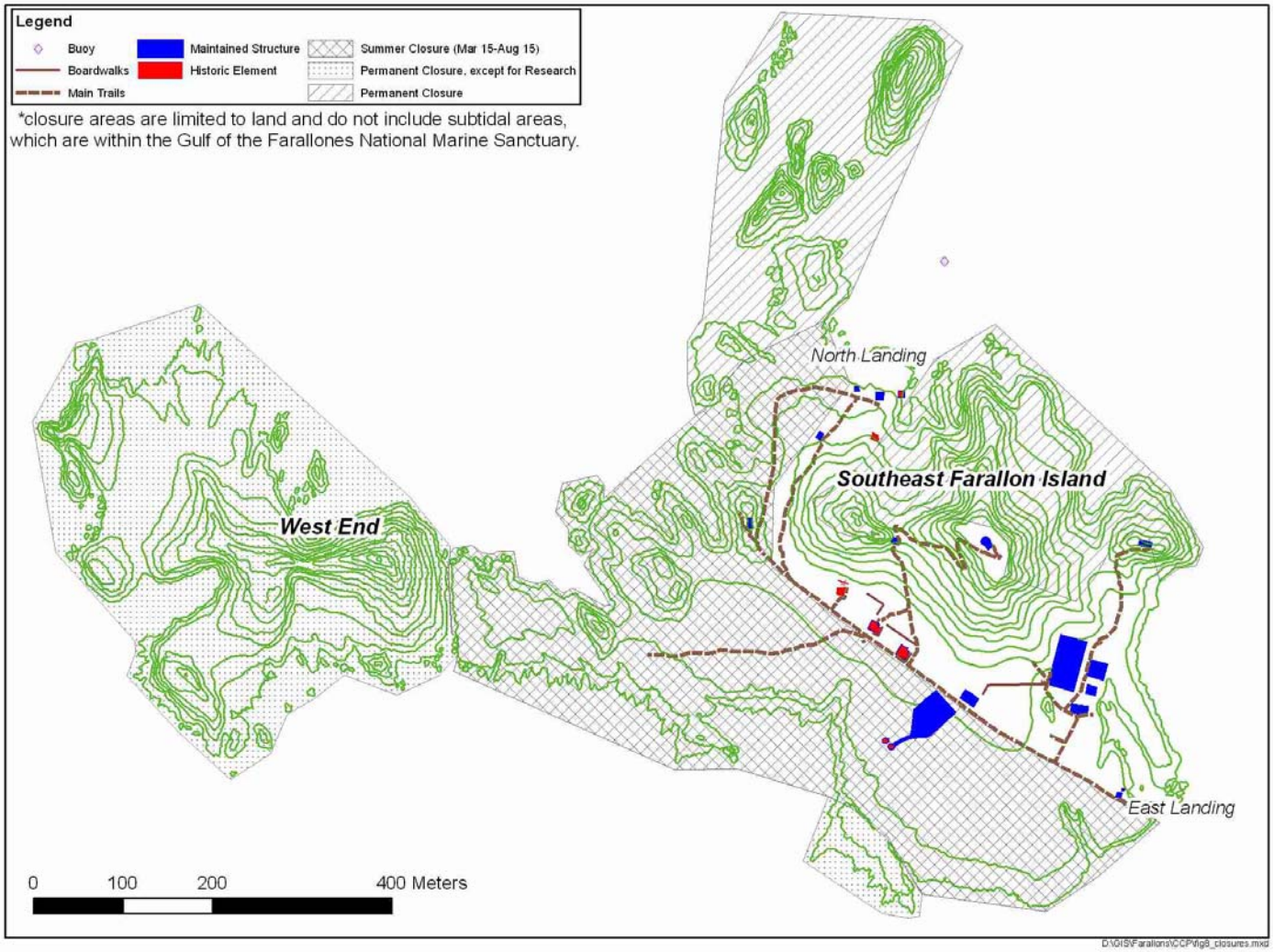
Certain parts of SFI are closed even to staff monitoring and management activities for the dual purpose of reducing spread of nonnative vegetation and limiting human disturbance to wildlife and their habitat. Figure 8, South Farallon Island Closure Areas depicts closure areas.

The Service, PRBO staff, and a handful of volunteers have conducted regular removals of nonnative vegetation that cover nesting burrows since late the 1980s. A Weed Management Plan (Appendix N) was completed in 2004 and continues to be adapted as new control methods are explored. New Zealand spinach and cheeseweed have been the primary focus of invasive species management. Vegetation removal is accomplished by hand-pulling and herbicide application using backpack sprayers. Intensive hand-pulling takes place primarily in February and March, when native annuals are actively growing and would be damaged by herbicide spraying. Between April and mid-August, no vegetation management is conducted to prevent disturbance of nesting seabirds. In mid-August, an intensive and selective herbicide treatment (4 percent glyphosate (Round-up) herbicide solution) is conducted to remove the target weeds that have sprouted during the seabird nesting season. Follow-up herbicide application occurs in September and October, prior to the winter rains, to remove missed plants and sprouts. Opportunistic pulling by PRBO staff and interns and Service staff occurs throughout the year as funding and other work priorities allow. Service volunteers alone spent more than 200 hours pulling weeds in 2005 and 2006.

Jesse Irwin (former refuge operations specialist) weeding
USFWS

Infestation of New Zealand spinach and cheeseweed varies from year to year, depending on precipitation patterns and hand-pulling efforts in the spring. Weather patterns that produce late-season rains and reduced weeding in the spring usually result in an abundance of weeds during the seabird nesting season. Precipitation was above average in 2005-2006; usually, above-average rainfall results in higher late summer weed densities. However, an intensified hand-pulling effort by volunteers during the late winter/early spring kept invasives under control. The 2005 rainy season continued well into June, producing a bumper crop of weeds; cheeseweed in particular formed homogenous stands and reached heights greater than seven feet (Buffa 2005). During 2004, average precipitation and consistent control efforts kept weeds in check.

Figure 8. South Farallon Island Closure Areas



Second priority for nonnative vegetation removal is grasses (*Avena fatua, Bromus diandrus, Cynodon dactylon*, *Festuca* sp., and *Hordeum murinum*) and plantain. Thick mats of these species on the Marine Terrace may hinder nesting auklets. Grasses have been cleared in small areas on a sporadic basis, but tend to reinvade the cleared area within 2–3 years. Hand-pulling is not desirable because of the amount of soil disturbance it causes, and not practical because of the extent of grass/plantain coverage. Herbicide treatment of grasses is problematic because these species actively grow during the winter/spring rains when native maritime goldfields are growing. Spraying with an 18 percent solution of sethoxydim (Poast), a grass-specific herbicide, has been conducted at selected locations on a limited basis and results are being evaluated. Plantain is established across the Marine Terrace and up Lighthouse Hill. This infestation reduces available nesting habitat for burrow-nesting auklets, but suitable treatment options have not yet been found.

Vegetation is currently being mapped using GPS units to provide more accurate data on the locations of vegetation species and the progress of control efforts. A comprehensive plant monitoring assessment is conducted every 3 years by an independent consultant. Any new nonnative plants found on the island are documented, photographed, and removed to prevent establishment and expansion.

Volunteer Karen Davis pulling New Zealand spinach
USFWS

Wildlife and Habitat Management

Wildlife populations on the Refuge have increased as a result of protection of seabird nesting habitat and pinniped haul-out areas from human disturbance, and as populations of some species (e.g., common murres, northern fur seals) rebound in response to reduced mortality from gill netting and other off-Refuge factors, including changing in food supply.

Several types of monitoring and research studies are conducted year-round on seabirds and pinnipeds that use the Refuge for breeding, resting, or roosting (Table 7).

Table 7. Monitoring and Research Studies on SEFI

Species	*Burrow Counts*	*Chick/Fledging Production*	*Nest Monitoring*	*Diet Sampling*	*Population Size*	*Banding*
Ashy storm-petrel		X	X			X
Leach's storm-petrel						X
Rhinoceros auklet	X	X	X	X		X
Cassin's auklet	X	X	X	X	X	X
Tufted puffin					X	
Pigeon guillemot		X	X	X	X	X
Western gull		X	X		X	X
Common murre		X	X	X	X	X
Pelagic cormorant		X	X		X	
Double-crested cormorant					X	
Brandt's cormorant		X	X	X	X	X
Black oystercatcher		X	X		X	X
Landbirds					X	X
Brown pelican					X	

Species	*Tagging*	*Pups Produced*	*Census*	*Monitoring*
Elephant seal	X	X	X	
Northern fur seal		X	X	
Steller sea lion		X	X	
Harbor seal		X	X	
California sea lion		X	X	
Whales				X (land based)
Bats				X
Arboreal salamander				X
White shark				X (land based)

Each nesting season, PRBO monitors population sizes and reproductive performance of 11 breeding birds on SEFI. Nesting boxes have been installed to facilitate reproductive monitoring of burrow and crevice-nesting species. The total number of pinnipeds hauled out on SEFI and portions of West End visible from the Lighthouse and other vantage points are counted once a week. The number of pups born each year to the main breeding species—elephant seal, northern fur seal, and Steller sea lion—are monitored. Harbor seal and California sea lion pups are tallied when they occur. Whales, dolphins, and porpoises are counted as they pass by the island. Most monitoring and other studies take place from observation blinds or vantage points on the Refuge; a few boat-based surveys are conducted during the seabird breeding season. Migrant landbirds are tallied each day and are mist-netted and banded daily in the fall. These monitoring studies have been ongoing for more than 35 years and represent some of the longest continuous datasets for certain species. In recent years, monitoring of bats (fall) and arboreal salamanders (winter) has been initiated.

Gray whale off South Farallon Island
© Jesse Irwin

Service staff conducts aerial counts of breeding murres and Brandt's cormorants on the entire Refuge, including the North Farallons, during the peak of spring nesting. The colonies are photographed from a twin-engine plane, and the breeding birds are later counted using a dotting technique. These and other ongoing or recent monitoring activities conducted by Refuge staff are listed below.

- *Aerial census of murre colonies*. Colonies are photographed using a 35mm camera with 300mm lens from a twin-engine Partanavia airplane. Photographs are taken at an altitude of 800–1,000 feet above the colony. Slides are projected onto white paper, and each bird is marked with a felt pen; the marks are counted for each colony.

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

- *House mouse population dynamics*. A study to document the population cycle of house mice on SEFI was conducted from March 2001 through February 2003. Four transects, each consisting of seven trapping sites, were established in various habitat types around the accessible portions of SEFI.

- *Boardwalk burrow study*. A study of Cassin's auklets colonizing newly created/protected habitat around SEFI buildings was initiated in 2001. It is funded by oil spill restoration funds through 2010. Objectives are to quantify the number of auklets nesting under 812 feet of boardwalks that were constructed in September 2000, and compare burrow density to the

density natural sites. Of particular interest is whether the "auklet-friendly" design (i.e., providing gaps between boards to permit auklets passage) encourages nesting.

PRBO also conducts studies and research, some of which have been ongoing for several decades. These are listed below.

- *Population demography of the western gull.* 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.

- *Demography, population dynamics, and food habits of common murre.* Four study plots (Shubrick, Upper Upper, Cliff, and Tower) are monitored daily during the breeding season to determine number/location of breeding sites, phenology, breeding success, incubation, and chick-rearing periods. Intensive observations are made of parental care, chick diet, feeding intervals, and foraging trip duration. Diurnal feeding rates are determined by conducting 4 all-day censuses. Studies of the fish adults feed to chicks have shown that northern anchovy, sardines, and juvenile rockfish are the most important provisioning items.

- *Demography, population dynamics, and food habits of Brandt's cormorants.* Breeding/productivity studies are conducted at Upper Shubrick and Corm Blind Hill. Reproductive success of known-age birds is being investigated to determine parameters such as age at maturity, fecundity, longevity, mate/site fidelity, survival to breeding age, and how these factors relate to breeding effort and success. Cormorant diet is determined by collection of pellets in breeding colonies before and after the breeding season.

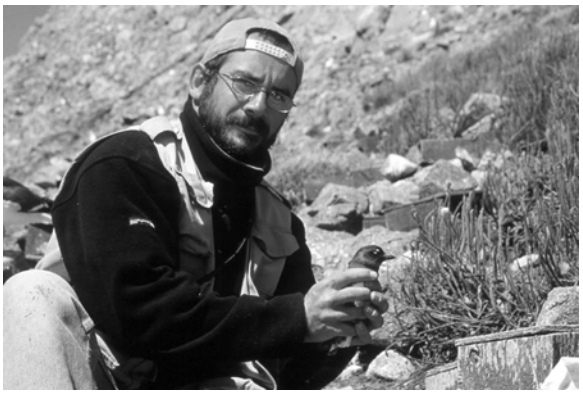
- *Demography, population dynamics, foraging ecology and diet of pigeon guillemots.* Survivorship and parental care is studied by observing color-banded birds. Diet watches are conducted at known sites. Observers record site number, band markings, time, and the prey species being taken to breeding sites.

Pigeon guillemot chick

© Jesse Irwin

- *Demography, population and diet of rhinoceros auklets*. A mark/recapture study was begun in 1987. The objectives of this study are to more accurately determine population size, although data have not yet been analyzed. Birds are mistnetted at four sites, and food items carried in by netted birds are collected and identified.

- *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.



PRBO intern Manuell Grosslet with Cassin's auklet
USFWS

- *Colony formation in Cassin's auklet*. This study was initiated in 1990 to investigate the impacts of western gull predation on Cassin's auklets. Specifically, it addresses the question of whether gulls prevent auklets from colonizing areas that have previously supported high densities of nest burrows. Ten 100-square-meter plots are monitored during peak incubation.

- *Population status and productivity of Ashy storm-petrel*. A mark-recapture study using mistnetting was initiated in 1992 to estimate population size and assess population trends. Productivity of Ashy storm-petrels is monitored at known natural crevice nesting sites.

- *Ashy storm-petrel predation monitoring*. Standardized collection of Ashy storm-petrel wings along the Lighthouse Path and collection of owl pellets from known roosting sites were initiated in 2000 to quantify predation by western gulls and burrowing owls.

- *Tufted puffin*. Breeding population estimates are made by conducting daily observations during a week-long period in mid-May and another in early August. Puffins breed in inaccessible rock crevices on the Refuge, and whether a known breeding site is active in a particular year is determined from observed behaviors of the birds (e.g., a pair seen at the entrance, a bird entering the crevice with nesting material or fish).

- *Black oystercatcher*. Historic nesting sites are monitored.

- *Reproductive ecology and survival of 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. Studies have been conducted annually since the Farallons were recolonized by breeding seals in 1972.

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

- *Arboreal salamander surveys.* A study was initiated in 2006 to assess the population and trends on SEFI. Surveys are conducted between September 1 and March 2 under cover boards and in auklet boxes. Salamanders are measured, weighed, sexed, checked for injuries and eggs, and are marked.

Arboreal salamander

- *Migratory bat monitoring.* Surveys have been standardized in recent years to assess several bat species on SEFI: hoary bat, western red bats, free-tailed bat, little brown bat (*Myotis lucifugus*), and Eurasian pipistrellus (*Pipistrellus* sp.). Surveys take place between August 15 and November 1. The goals of the survey are to determine roosting locations on the Refuge, assess the number of bats using the Refuge during migration, assess interaction between male

and female bats on the Refuge, and assess the effects of weather conditions on bat arrival at and departure from the Farallons.

Wildlife is also monitored for any unusual incidents that would signal environmental problems. For example, island personnel record observations of oiled birds, marine mammals entangled in debris, and dead animals. A protocol has been established to respond to elevated frequencies of oiled birds and/or an oil spill. Unusual die-offs are reported, and sometimes samples are collected and submitted for laboratory analysis.

Most research occurring on the Refuge is conducted by PRBO, but the Refuge occasionally issues special use permits to other researchers if their studies are compatible with Refuge goals and purposes and fulfill a priority information need. Current studies are listed below.

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

- *Genetic variation study of western, yellow-footed, and glaucous-winged gulls*. Blood samples were collected from 30 Farallon western gulls in July 2005 as part of a study by UC graduate student Carolina Pickens.

- *Marine mammal monitoring*. NMFS conducts annual aerial surveys to count pinnipeds hauled out on South and North Farallon Islands.

Other recent academic and agency research studies have investigated tick-born virus of common murres and hoary bat migration.

Other Management Activities

Unneeded structures and concrete foundations have been removed in order to maximize natural habitat available to wildlife. Additional habitat has been created for crevice-nesting seabirds from unused concrete foundations. In 2000, a *Habitat Sculpture*, containing 32 nesting boxes and an observation blind, was constructed near North Landing by Meadowsweet Dairy. Concrete blocks were stacked in a design engineered to create habitat for crevice-nesting birds. Debris such as old pipe and tanks are removed as funding allows so that it does not become a wildlife hazard.

Habitat sculpture by Meadowsweet Dairy
USFWS

The Refuge has instituted a number of management practices to minimize the human footprint and human disturbance. The most wildlife-sensitive areas of the Refuge are permanently closed to human contact, including research, in order prevent wildlife disturbance and the spread of nonnative plants. In September 2000, 812 feet of boardwalks were constructed in heavily traveled areas around the houses and monitoring sites at the base of Lighthouse Hill to protect and enhance habitat for nesting auklets. The boardwalks were constructed to allow auklets access for digging nesting burrows underneath and adjacent to the walkways. Five years of monitoring burrow density and occupancy rate has shown that boardwalks with the "auklet trough" design were successful in expanding habitat for Cassin's auklets (Buffa 2005). Night lighting is screened and minimized to prevent disruption of nocturnal species. A solar power system was installed to avoid the use of noisy generators and minimize the risk of a diesel fuel spill.

Threatened and Endangered Species Management

Human activities are managed to avoid areas where Steller sea lions and California brown pelicans (in the process of being delisted), the only listed species on the Refuge, congregate. It is Refuge policy to minimize disturbance of pinnipeds and all other wildlife. Low-flying aircraft and boats approaching too close to shore are monitored by island personnel, and hailed by radio to warn them away. If wildlife disturbance is observed, a violation report documenting the disturbance and other information is prepared and sent to Refuge Law Enforcement personnel, who follow up with a warning or citation.

Specific management actions that the Refuge has taken to protect these two species include a number of restrictions on helicopter use. Helicopter landings are strictly limited (See Figure 9) to avoid important Steller sea lion haul-outs and California brown pelican roosting areas, as well to prevent seabird disturbance. No helicopter landings are allowed between March 15 and August 15, the period encompassing the Steller sea lion pupping season. Approach and departure paths for helicopters are strictly limited to avoid Steller sea lion concentration areas and brown pelican roosts. For example, no helicopters are permitted to overfly West End, a major brown pelican roosting area.

Access to West End by PRBO and Service personnel is strictly limited and controlled even for research and management purposes to avoid disturbance of pinnipeds and pelicans. Access for elephant and fur seal monitoring is restricted, and then only when it can be conducted in a way to

avoid flushing Steller sea lions and seabirds. No access to West End is allowed during the Steller sea lion breeding season.

From a distance, roosting pelicans are censused daily, and Steller sea lions (along with other pinnipeds) are censused weekly. The Refuge also cooperates with NMFS personnel as they conduct annual aerial pinniped counts.

Fire Prevention and Hazard Reduction

Fire prevention is a high priority. The household electrical and photovoltaic power systems are checked on a regular basis, and any worn or broken parts are replaced. The fire hoses are inspected annually and replaced as needed. The plumbing is maintained in a ready state to fight a fire if needed. Island biologists inspect fire extinguishers monthly and are trained in their use.

Wilderness Review

The Wilderness Act of 1964 (16 USC 1131-1136, 78 Stat. 890) directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within the NWR and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System. Wilderness reviews are a required element of CCPs and are conducted in accordance with the refuge planning process outlined in 602 FW 1 and 3, which includes public involvement and NEPA compliance.

There are three phases to the wilderness review: (1) inventory, (2) study, and (3) recommendation. Lands and waters that meet the minimum criteria for wilderness are identified in the inventory phase. These areas are called wilderness study areas (WSAs). WSAs are evaluated through the CCP process to determine their suitability for wilderness designation. In the study phase, a range of management alternatives are evaluated to determine if a WSA is suitable for wilderness designation or management under an alternate set of goals and objectives that do not involve wilderness designation. The recommendation phase consists of forwarding or reporting recommendations for wilderness designation from the Director of the Service through the Secretary of the Interior and the President to Congress in a wilderness study report.

The Farallon Refuge, excluding Southeast Farallon, was given wilderness status on December 26, 1974 (Public Law 93-550), comprising 141 acres of designated wilderness. The Farallon Wilderness Area comprises rocks and islets of SFI (excluding SEFI), Middle Farallon, the North Farallons, and Noonday Rock. Isolation and inaccessibility have kept and continue to keep people and Refuge staff from these areas. Monitoring of wildlife on West End and surrounding islets is conducted from vantage points on SEFI, by boat, and by periodic foot trips to West End as mentioned above. Wildlife on the North Farallons is monitored 1–2 times a year by air, and much less frequently by boat.

A Wilderness Management Plan (Appendix H) was published in 1978. SEFI was evaluated as part of the 1974 wilderness review process, and again as part of this CCP, and was determined not to meet wilderness criteria because of its extensive human imprint. The Service does not anticipate

amending the existing wilderness management plan because it does not believe that the process would further facilitate restoration to presettlement conditions.

Law Enforcement and Resource Protection

There are a number of management guidelines for those visiting the area surrounding the Refuge. Harassment of wildlife, including unintentional harassment, is strictly prohibited under 50 CFR Sections 27.34 and 27.51. Any disturbance that causes wildlife to flush can be cited and fined. Any overflights above the Refuge are encouraged to follow FAA recommendations to fly above 2,000 feet above the GFNMS. Between March 15 and August 15, no helicopter landings are permitted on SEFI (Figure 9). In addition, aircraft that flies within 1,000 vertical feet and 0.5 horizontal mile of SFI are monitored closely; identification numbers and wildlife disturbance are documented, and appropriate enforcement action (warning or citation) is taken.

Boating regulations must comply with California regulations including abiding by the 5 mph speed limit within 1,000 feet of all islands. In addition, there are noise restrictions within 1,000 feet of the shoreline of all the islands. Between March 15 and August 15, vessel traffic is prohibited within 300 feet of the shoreline at specified portions of SEFI and the North Farallons (Figure 10). This prohibition includes no boats passing between Saddle Rock and SEFI.

Figure 9. Flight Restrictions

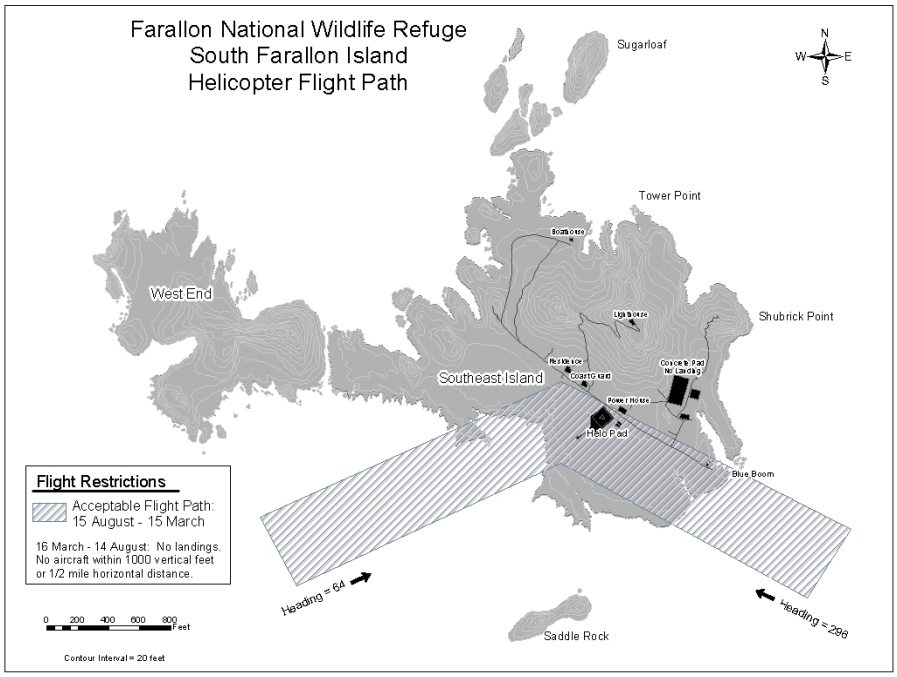
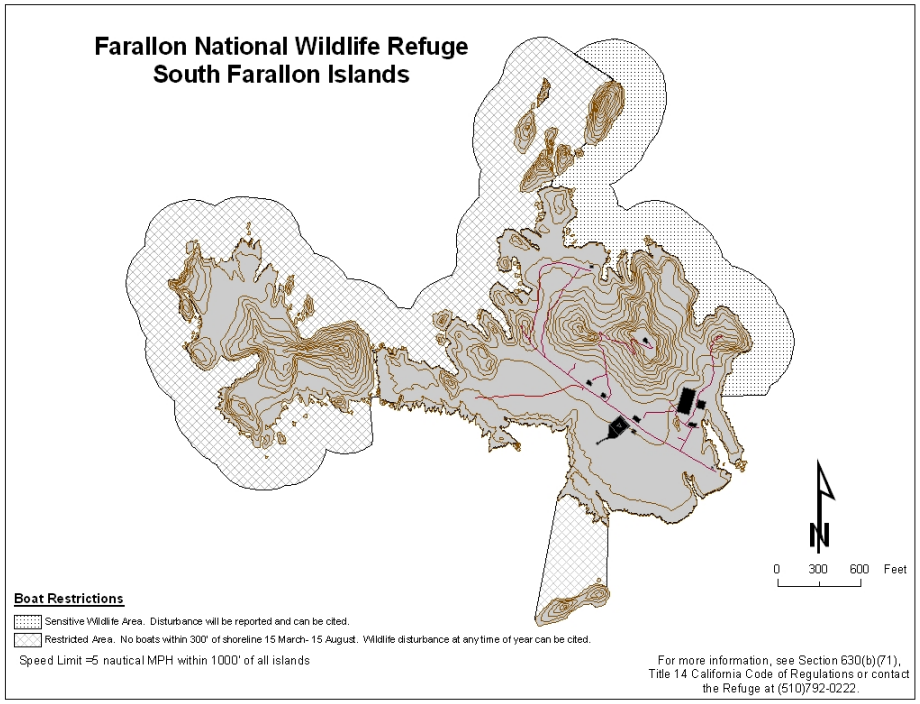


Figure 10. Boating Restrictions



Cultural Resource Management

Cultural resource assessments are conducted when proposed construction activities may disturb soil or affect historical structures or their setting. Recent cultural resource assessments have focused on renovating historical structures on the Refuge. Assessments by Service cultural resources staff are conducted to determine if such construction may alter the historical integrity of the structures. Past assessments are listed in Chapter 3.

In 1998, a team from the University of California Los Angeles (UCLA) Institute of Archeology conducted a surface archeological survey of SEFI and mapped a number of historic sites and artifacts spanning the Russian/American fur harvest period, the egg harvest period, and the military period. Every attempt is made to preserve or mitigate impacts on cultural and historical elements during construction on the Refuge.

Facilities Maintenance

Infrastructure and facilities on SEFI are sized to support a field station staff of eight. Structures and management activities on the Refuge have been developed to minimize impacts on wildlife and resources. Recycling has been implemented and consumption minimized to control resource use and waste generated on the Refuge. More than 90 percent of the Refuge's electricity is supplied by solar power. Water is collected through rain catchment devices, and the Refuge does not require external water sources.

Cleanup with U.S. Coast Guard
© Jesse Irwin

Maintaining facilities in this remote, corrosive, harsh marine environment is a continuing challenge. Salt water, constant dampness, stiff winds, and deposits of guano all contribute to more than normal wear and tear on buildings, systems, metal components, and human nerves. Construction, replacement, and repair of infrastructure are ongoing and expensive. Stainless steel or other durable, noncorrosive materials are required. The U.S. Coast Guard also conducts operations on SEFI, such as maintenance of the lighthouse, on a limited basis.

Volunteer rebuilding the Pumphouse
© Jesse Irwin

Transportation of materials and technical specialists between the mainland and Refuge is often difficult, and the logistics can be daunting. The Refuge does not own a boat capable of transporting

and offloading materials between the mainland and SEFI. The Refuge utilizes the Farallon Patrol (see *Volunteers and Partners* below) or charters a boat large enough to make the ocean crossing. Cargo and personnel are then transferred to the Refuge's 16-foot skiff, which is lifted onto the island by an electrically powered derrick. This laborious effort can only take place when seas are calm, and it is only suitable for lightweight cargo and personnel. Transporting equipment, particularly heavy or bulky items, is logistically complex and expensive. Occasionally, helicopter transports are conducted through partners such as USCG. Helicopter landings are only allowed between August 15 and March 15 to protect nesting birds. Equipment must be sling-loaded or carried inside a very large helicopter. Slung loads cannot be transported over populated areas or major highways, so equipment must be staged at a coastal landing spot (usually Half Moon Bay Airport). Frequent fog or high winds can cancel a planned helicopter trip at the last moment.

Numerous contingency plans must be in place for a successful maintenance project. Sensitivity to the island's fragile wildlife, a willingness to be posted in this remote situation, ability to work in a harsh environment, flexibility, and a good sense of humor are essential.

Safety

Safety is a priority concern on the Refuge because it is remote and emergency services (e.g., local fire department, paramedics) are not immediately available. Personnel on the Refuge are trained to take safety precautions and to handle emergency situations. A safety officer from the San Francisco Bay NWR Complex conducts a safety audit of the Refuge every 1–2 years.

Volunteers and Partners

Volunteers provide countless hours of service to needed management activities on the Refuge. During 2005, 25 volunteers donated about 11,400 hours of service on SEFI. Volunteer activities include assisting with nonnative plant control; bird, mammal, and white shark monitoring; research; collecting meteorological and oceanographic data; mouse-trapping activities; and performing facility and equipment maintenance.

The Refuge has benefited from partnerships with several entities and individuals. Management of this Refuge is heavily reliant on relationships with these partners to provide transportation and monitoring.

PRBO began baseline wildlife surveys on SEFI in 1968, and the Service initiated a cooperative agreement with PRBO for wildlife survey and protection in 1972. Under the current agreement (revised in 2005) PRBO monitors wildlife populations, provides Refuge protection, performs preventative maintenance on equipment and facilities, coordinates the Farallon Patrol, oversees visitors on Special Use Permits, and conducts other caretaker duties. PRBO generally staffs the Refuge with one biologist and 3–5 interns. The personnel on the Refuge varies seasonally with research activities. PRBO collects information on breeding seabirds mid-March through August, monitors landbirds and other migratory wildlife in September through November, and conducts population studies on elephant seals December to mid-March. PRBO matches the Service's

monetary contribution to the Cooperative Agreement at a 2:1 ratio through in-kind services and supplies.

PRBO and refuge staff
© Ellie Cohen

The Service shares management responsibilities for SEFI through a cooperative Management Use Agreement with USCG, which was signed in 1972 and modified in 1984. It is somewhat out of date. USCG provides air support for Service personnel during the helicopter landing season (mid-August through mid-March). USCG annually provides up to 50 helicopter flight hours transporting Service and other agency personnel to SEFI. USCG has reduced its presence considerably since solarizing the lighthouse in the early 1990s, and plans to relinquish its primary jurisdiction land order, instead acquiring an easement for ingress and egress to maintain the navigation light. Negotiations with the affected agencies are expected to occur prior to this action.

U.S. Coast Guard helicopter
USFWS

The National Weather Service (NWS) maintains and operates permanent weather monitoring devices on SEFI under Special Use Permit. PRBO takes weather measurements three times daily

and reports them to NWS. NWS accesses SEFI under a Special Use Permit twice yearly to calibrate and maintain its equipment.

University of California Berkeley Seismology Lab installed sophisticated GPS and seismographic sensing equipment in the mid 1990s under Special Use Permit. The Farallon Islands are in a unique location to provide essential earthquake information on the western side of the San Andreas Fault. UC Berkeley has also provided general Refuge support, installing and maintaining the Refuge's email/internet system and providing personnel to repair radio communication equipment.

The National Oceanic and Atmospheric Administration (NOAA) manages the GFNMS, which encompasses the water surrounding the islands below mean tide. Sanctuary personnel access SEFI three times yearly under a Special Use Permit to conduct intertidal monitoring. This research provides data on island ecology and conditions that are beneficial to both the Sanctuary and the Refuge. Additionally, the Refuge and the GFNMS split the cost of maintaining the two mooring buoys at East and North Landing.

A volunteer vessel group called the *Farallon Patrol* provides transport of supplies and staff to and from the Refuge. Weather permitting, they take turns making runs, mostly by sailboat, to the island twice a month. This dedicated group of skippers has been volunteering their time, fuel, and equipment for more than 35 years.

Intermittent volunteers provide considerable time toward habitat restoration projects and upkeep of facilities. One hundred or more hours are logged each year by volunteer weed pullers. Volunteers including plumbers, motor mechanics, carpenters, and other skilled trade workers provide services in exchange for a few days or weeks spent on the island. The radio and phone systems were maintained by a volunteer for many years. Past projects include construction of a boardwalk to protect sensitive auklet habitat, debris removal, and creation of seabird nesting habitat from derelict concrete foundations.

Visitor Programs

Environmental Education

Educational materials and information are provided to schools and individuals as requested. In 2005, an educational program that explores the food webs (called Webs under Waves) of the central California coastal marine environment was developed and implemented targeting third- through fifth-grade students. Through the program, students learn about habitats of the Farallones National Marine Sanctuary and Farallon NWR, as well as restoration efforts for common murre at Devils Slide Rock. Schools in Marin, Sonoma, San Francisco, and San Mateo Counties were selected to participate in the program. During the 2006 pilot year, 650 students and 26 teachers were involved.

Fishing and Hunting

Recreational fishing and hunting activities are not currently permitted on the Refuge, only from the waters off the Refuge. Fishing in the waters surrounding the Refuge is regulated by the State of California and GFNMS. Recreational fishing charter boats frequent the waters near the Refuge when the fish are biting. Commercial fishing boats also fish near the Refuge.

Wildlife Observation

The Refuge is closed to the public. However, sightseeing boat tours circumnavigating the Refuge are offered by one nonprofit organization and several private companies. One concession also began operating sharkwatching for cage divers and topside viewers in 2004 and 2005 (Buffa 2005). Information on attendance and other details for both these activities were described in Chapter 3.

Southeast Farallon Island
USFWS

Outreach

Refuge outreach is primarily conducted through media requests for tours and interpretive materials at the San Francisco Bay NWR Complex. PRBO also conducts seabird outreach and education activities through its Seabird Aware and Night Lights programs. For many years, one-day tours have been provided under special use permits to individual media representatives who meet certain criteria. During 2005, due to broad public interest, the Refuge organized the first media trip for a dozen reports and photographers. Information about the Refuge has been provided at the California State Fair and has also been made available at the GFNMS Visitor Center.

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Chapter 5. Management Direction

Farallon NWR Vision Statement

The imprint of California history and local wildlife is deeply embedded in the Farallon Islands, the largest seabird nesting colony in the contiguous United States. Refuge staff work to integrate the historic and future human imprint in a way that continues to enhance habitat and populations of nesting seabirds, marine mammals, and migratory species. Further, the human history and natural resources are shared with San Francisco Bay area residents and visitors. This is achieved in partnership with other organizations through monitoring, research, protection, and habitat restoration. Through high quality environmental education and interpretive opportunities, Bay Area residents and visitors are aware of and take stewardship of this jewel of the California coast.

Refuge Management Goals, Objectives, and Strategies

Refuge management activities are articulated through goals, objectives, and strategies in this CCP. The Service defines a goal as a "descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose, but does not define measurable units."

The Service defines objectives as concise statements of what will be achieved, how much will be achieved, and when and where it will be achieved on a refuge. Objectives are derived from goals and are accomplished through management strategies that specify the actions, tools, techniques, or combination thereof. Goals were developed to provide management directions in four principal areas: wildlife management, habitat management, wildlife-dependent public use, and cultural/wilderness resources. The four Refuge goals are presented below, followed by detailed descriptions of the associated objectives, strategies, and rationales that support and implement them (See Figure 11 for a depiction of some of the management actions).

Goal 1: Protect, inventory, monitor, and restore to historic levels breeding populations of 12 seabird species, five marine mammal species, and other native wildlife. Maintain and develop partnerships to support wildlife and habitat conservation on the Refuge.

Goal 2: Restore degraded habitat and reduce the prevalence of nonnative vegetation in order to re-establish historic abundance and distribution of native plant species.

Goal 3: Increase public awareness of the marine environment and the Refuge's purposes through wildlife-dependent recreation, environmental education, and interpretation opportunities, while preserving and enhancing wildlife populations and the wilderness character of the Refuge.

Goal 4: Inventory and preserve the valuable cultural and wilderness elements of the Refuge in order to chronicle the history of the Farallon Islands and share this knowledge with the San Francisco Bay Area community and the public as a whole.

Wildlife Management

Goal 1: Protect, inventory, monitor, and restore to historic levels breeding populations of 12 seabird species, five marine mammal species, and other native wildlife. Maintain and develop partnerships to support wildlife and habitat conservation on the Refuge.

Background

The Refuge was established as a preserve and breeding ground for native birds. The Refuge is also a historic haul-out and breeding site for five pinniped species. These seabird and marine mammal populations were dramatically affected by hunting and egg collecting. Some species, such as northern fur seal, were extirpated by hunting in the 1800s, and have only recently begun to pup on the Refuge again. The Refuge will strive to increase populations of seabirds and pinnipeds on the islands to historical numbers through removal of predators, increased habitat restoration, protection, research, and adaptive management.

Objective 1.1: Within five years of the CCP's approval, reduce or eliminate nonnative wildlife species and problem individual animals (e.g., house mice, individual burrowing owls, western gulls) that threaten the viability of seabird and marine mammal species so that less than ten percent of native populations are adversely affected by nonnative wildlife on SEFI.

Rationale: Predation by native and nonnative species has resulted in losses of native seabird species on the Refuge. House mice were introduced to SEFI by human occupants and have not been properly controlled. Their high numbers in the fall have attracted burrowing owls to remain on SEFI through the winter. When the mouse population crashes in the winter, the owls begin to prey on Ashy storm-petrel adults that return to the Refuge to breed. Removing house mice would discourage burrowing owls from overwintering on the island, therefore reducing pressure on the Ashy storm-petrel population. Western gull individuals have also been known to predate on Ashy storm-petrels at rates that result in population instability. Sydeman et al. 1996 conducted a population viability analysis on SEFI Ashy storm-petrels that found adult survival to be the primary indicator of population change, and that Western gull predation on adult storm-petrels to account for such low estimates of survival.

Strategies:

- Develop a plan to eradicate the nonnative house mouse through rodenticide application and prevent future human introductions of mice.
- Monitor and reduce predation on declining Ashy storm-petrel populations by western gull; study extent of problem and methods to lower predation rate. Monitor gull nests for storm-petrel remains. Conduct experimental take of no more than ten problem gulls annually through a Migratory Bird Treaty Act permit to determine efficacy.
- Until mice are eradicated, translocate individual problem owls that overwinter on SEFI.

Objective 1.2: Over the 15-year period covered by the CCP, reduce and/or avoid human disturbance to wildlife throughout the Refuge through annual coordination with relevant agencies including USCG, CDFG, and GFNMS.

Rationale: Aircraft and vessels transiting near the Refuge have caused wildlife disturbance on the Refuge. While staff on the Refuge monitor and attempt to prosecute these incidents with available resources, a more coordinated effort to monitor vessels and aircraft in partnership with other agencies would provide more coverage and better enforcement.

Strategies:

- Maintain the policy of restricted public access to the Refuge. Enforce trespassing policies and seasonal closures, documenting incidents of trespass and wildlife disturbance. Attempt to prosecute the offenders.
- Continue to monitor and report wildlife disturbances by aircraft overflights and boats. Relay pertinent information of disturbance activities to the GFNMS, CDFG, and USCG enforcement authorities as appropriate.
- Work with GFNMS and other relevant parties to deploy buoys to mark closed areas for seasonal and permanent closures. Evaluate the need to expand closure areas.
- Evaluate current signage needs.
- Jointly identify jurisdictions, land use policies, and an enforcement plan.
- Coordinate with CDFG, GFNMS, Golden Gate National Recreation Area (GGNRA), and other agencies to establish or maintain existing memorandums of understanding (MOU) for joint law enforcement coordination to prevent boating disturbance to wildlife.
- Update the Management Use Agreement with USCG to address operations and maintenance on SEFI when USCG relinquishes its land on the Refuge.
- Work with the Federal Aviation Administration (FAA) and USCG to identify refuge areas on aeronautical charts and develop "notice to pilots" to expand outreach to reduce aircraft-induced wildlife disturbance on the Refuge.
- Coordinate with USCG and GFNMS to develop an outreach program for boaters and private/military pilots.
- Continue to minimize the footprint of daily monitoring, management, and operational activities.

Objective 1.3: Over the 15-year period covered by the CCP, support regional efforts to prevent and/or contain oil spills and other contaminants near the Refuge's islands to protect seabird and other wildlife.

Rationale: The Refuge is located near commercial shipping lanes which make it vulnerable to oil and other contaminant spills. In the winter of 1986, the oil barge Apex Houston accidentally discharged some 26,000 gallons of oil while en route from San Francisco to Long Beach Harbor. About 9,900 seabirds were killed as a result of the spill, of which about 6,300 were murres. Common murre colonies on the California coast were devastated by this spill. Other oil spills, including a leaking sunken ship, the Luckenbach, have caused additional seabird deaths. Most recently in November 2007 in the Cosco Busan oil spill, staff on the Farallons observed 297 oiled individuals (mostly birds) including common murres, western gulls, Brandt's cormorant, California gull, and northern fur seal. In response to these spills, a regional spill prevention and response network has been put in place. Oil spills will continue to be a risk given the Refuge's proximity to commercial shipping lanes and staff should work collaboratively with other partners to limit wildlife impacts.

Strategies:

- Train staff that work on the Refuge to identify, respond to, and report oil spills. Island staff should attend the spill responder course given by Oil Spill Prevention and Response (OSPR) and NOAA.
- Monitor the occurrence of oiled seabirds on and around the Refuge and report numbers to the CDFG OSPR Network.
- Provide input for Hazardous Materials Response Plans, Area Contingency Plans, and other spill prevention/preparedness activities.
- Implement strategies developed through the Sanctuary Vessel Spill Plan and other plans to reduce oil pollution.
- Continue population estimates of seabirds and other wildlife, including intertidal surveys to be used as baseline data in the event of future spills.
- Coordinate with OSPR and Trustee Agencies to develop restoration and mitigation projects that restore resources lost in oil spills.

Objective 1.4: Continue to implement actions specified in threatened/endangered species recovery plans for California brown pelican and Steller sea lion, as well as other sensitive wildlife and implement at least one new research study that supports the management of these species.

Rationale: Federally listed threatened and endangered species are trust responsibilities under the jurisdiction of the Service. Threatened and endangered species and those proposed for federal listing are likely to become extinct due primarily to habitat destruction and introduced species. Steller sea lions use the South and North Farallon Islands as a year-round haul-out and pup on the Refuge in small numbers in the summer. California brown pelicans roost on the Refuge after dispersing from breeding areas farther south. Regional recovery plans for both species (NOAA 2006 and USFWS 1983) are in place. Refuge staff monitors these species and protects them from disturbance. The brown pelican population now exceeds recovery plan goals and the species is being considered for delisting. The eastern segment of the Steller sea lion population has been steadily increasing throughout its range except for southern and central California; the Farallon Islands breeding population has been declining.

Strategies:

- Reduce disturbance of threatened/endangered species on the Refuge by monitoring and preventing boat and aircraft disturbance.
- Review research conducted at Año Nuevo State Reserve on Steller sea lions and implement any appropriate management actions.
- Implement action items from the Steller sea lion and California brown pelican recovery plans.
- Encourage research studies on the Refuge that investigate possible causes of poor reproductive success and declining breeding populations of Steller sea lions on the Farallon Islands.

- Continue monitoring Steller sea lions and California brown pelicans and support long-term database management maintained by PRBO. Contribute to regional datasets, including those maintained by NMFS where appropriate.

Objective 1.5: Within three years of the CCP's approval, conduct a comprehensive review of the monitoring program and protocols for breeding, resident, and migratory wildlife on the Refuge to determine priorities, soundness of methodologies, adequacy of data storage and retrieval, relevance of new techniques, and current issue or information gaps. Revise monitoring protocols and priorities as appropriate.

Rationale: PRBO has been monitoring populations and reproductive success of 11 of 12 nesting seabird species and five pinniped species that use the refuge year-round or during the breeding season since 1968. Likewise, landbird and other migratory bird (e.g., shorebird) populations have been monitored daily, and observations of other species observed on or from (e.g., whales, dolphins) the Refuge have been recorded since 1968. The intertidal community has been monitored since the early 1990s by the GFNMS. Aerial surveys of the North Farallons and SFI are conducted by Service personnel annually, but funding to continue these surveys is not secure. NMFS conducts annual aerial pinniped surveys of the North Farallons and SFI when funding is available. In the last few years, standardized protocols have been implemented to monitor salamanders and bats. Most data and records are maintained by PRBO and GFNMS, with reports submitted annually. Studies have been added as needs or opportunities have arisen, but a comprehensive review has not been done. A review would provide for the best possible science, ensure a cost-effective monitoring program, attract new research collaborators, and ensure that an ecosystem approach is being used to guide management.

Strategies:

- Continue monitoring breeding population size, reproductive success, and dietary information for seabirds.
- Continue weekly pinniped census and collecting reproductive and resighting information on elephant seals. Support NMFS pinniped surveys.
- Investigate new techniques (e.g., remote video camera) or protocols to monitor the growth and reproduction of the northern fur seal colony on West End.
- Expand seasonal monitoring of arboreal salamanders (using cover boards) and bats to determine population size and distribution.
- Review/revise monitoring and research plan for landbirds.
- Encourage non-intrusive research studies that would help inventory and understand some of the Refuge's lesser known fauna, such as insects, bats, and salamanders.
- Secure partners or funding to continue conducting annual aerial seabird surveys of the North Farallons and SFI, including the tabulation of population numbers on a biannual basis at minimum.

Objective 1.6: Over the 15-year period covered by the CCP, identify and implement at least one study annually that benefits conservation and/or management of wildlife on the Refuge.

Rationale: Increasingly, Refuge staff observe population and productivity fluctuations in populations of seabirds and pinnipeds that rely on the islands. Because these fluctuations are not clearly understood, further research is necessary to identify actions that can protect and/or promote these populations. Assessing seabird and pinniped responses to environmental changes in comparison to existing long-term baseline data will be especially important in understanding the impacts of climate change on wildlife.

Strategies:

- Conduct boat-based or onsite investigation of the North Farallons at least twice within the 15-year plan horizon.
- Contribute seabird and pinniped monitoring data to regional efforts (e.g., seabird colony catalogues for California) and coordinate with other large-scale monitoring efforts.
- Repeat the 1989 auklet burrow survey. Develop a better method of tracking the population trends of Cassin's and rhinoceros auklets.
- Reassess breeding population size and trends of Ashy storm-petrels.
- Initiate/support studies that focus on the foraging ecology of breeding birds on SEFI, such as research initiatives that examine diet, energy expenditure, behavior, and environmental interactions of seabirds during the non-breeding season. Track long-term changes in the food web.
- Contribute to regional fisheries and other ocean-based management plans through staff participation.
- Establish and maintain partnerships with research institutes, state and other federal agencies, universities, and conservation groups, to collaborate on ecosystem-based and other joint research projects.
- Encourage Refuge staff to participate in professional societies, to attend agency-sponsored meetings/conferences, and to publish in peer-reviewed scientific journals.
- Integrate research on Farallon wildlife into studies on marine ecological consequences of climate variability and change, marine protected areas, marine ecosystem conservation, and fisheries management.
- Conduct a population viability assessment for Cassin's Auklet to understand recent breeding failure.

Habitat Restoration

Goal 2: Restore degraded habitat and reduce the prevalence of nonnative vegetation in order to re-establish historic abundance and distribution of native plant species.

Background

The Farallons have experienced considerable habitat change since humans have been present. Nonnative plant species have been introduced accidentally and purposefully. Some nonnative species have been spread by seabirds and house mice. The Service actively manages invasive vegetation, but a comprehensive plan to reestablish the historic distribution of native plants on SFI has not been implemented.

Objective 2.1: Within ten years of the CCP's approval, increase and enhance nesting and/or roosting habitat at Sea Lion Cove, Lighthouse Trail, and Marine Terrace by removing or reusing all unutilized artificial structures and replacing them with habitat for native vegetation and wildlife.

Rationale: Historically, Farallon Island seabird populations were dramatically reduced by human harvesting of adults and eggs. Although seabird populations are increasing, land where unnecessary human structures are located may be capable of providing additional habitat. Moreover, surplus materials have successfully been used to create burrowing habitat for seabirds. Reusing such materials for additional habitat structures would eliminate the need for costly offsite removal. Contribution of staff time and technical assistance to these strategies will support objectives in the regional seabird conservation plan.

Strategies:

- Identify and prioritize for removal of debris and other materials no longer in use (primarily concentrated on Marine Terrace).
- Utilize appropriate excess materials such as concrete blocks to build additional seabird nesting habitat, primarily in Sea Lion Cove.
- Rebuild Lighthouse Trail for crevice nesters such as Ashy storm-petrel, pigeon guillemot, Cassin's auklet, and Leach's storm-petrel.
- When constructing new structures, consider modifications that provide additional wildlife habitat.
- Assess whether increases in wildlife nesting have occurred in those areas where infrastructure has been removed, nest sites created, or plant restoration has occurred.

Objective 2.2: Continue to conduct vegetation surveys on SEFI every three years that quantitatively and qualitatively measure species composition along established transects and plots.

Rationale: Both the Service and the Refuge System identify native plant conservation in their mission statements. The Refuge currently supports substantial populations of nonnative plants that threaten both wildlife and the limited endemic native vegetation. Only SEFI supports substantial plant communities, whereas the other islands are primarily rocky outcrops often washed over by tides. The Service currently relies on one volunteer botanist to provide vegetation surveys on SEFI. Additional volunteers and resources are needed to fully inventory species and implement current recommendations and develop new ones. In addition, annual assessments through geographic information systems (GIS) mapping would be useful to determine if current activities and those set forth in the CCP are working to restore the Refuge to presettlement conditions.

Strategies:

- Finalize draft plant sampling protocols and manual.
- Recruit volunteers to conduct triennial plant surveys.
- Acquire all existing natural resource GIS layers and maps for the Refuge. Provide copies to the Regional office.
- Create a GIS database and map of vegetation types and track changes in targeted nonnative species over time. Provide copies to the Regional office.

- Digitize and catalogue historic plant photos and locations.

Objective 2.3: Within one year after the CCP's approval, continue to implement and annually update the Refuge's Weed Management Plan with the goal of decreasing the abundance and extent of target invasive species by 50 percent, primarily on the Marine Terrace and south-facing slope of Lighthouse Hill.

Rationale: Nonnative plant species have become a primary threat to the Refuge System and the Service's wildlife conservation mission. Islands can be particularly sensitive to the threat of invasive weeds. The Farallons' long human history has facilitated the spread of invasive plants to the Refuge. However, no assessment of the impacts of current human access onto the Refuge has been conducted. A Weed Management Plan was developed in 2004 (Appendix N). The long-term goal is to eradicate the two most invasive weeds on the Refuge: New Zealand spinach and cheeseweed. Nonnative grasses and plantain are a secondary problems. It is also important to assess and develop protocols for reducing new or subsequent introductions of invasive species by human traffic. Next steps include updating the Weed Management Plan, tracking management activities to determine their efficacy through quantitative scientific studies, and implementing new alternatives through the management plan should current actions be ineffective.

Strategies:

- Reduce footprint of New Zealand spinach and cheeseweed by 50 percent within 10 years of plan initiation and develop a strategy for eradication of 95 percent of these nonnative plants on SEFI annually by hand-spraying herbicide and manual pulling. Conduct intensive herbicide application in mid-August and follow up application in September or October. Hand-pull vegetation intermittently from November through early January, conduct intensive hand-pulling from late January through mid-March.
- Expand collection of maritime goldfield seeds in the summer and fall. Plant maritime goldfields on SEFI coinciding with first winter rains in areas where nonnatives have been removed.
- Document planting, removal actions, and efficacy of plant restoration efforts.
- Implement seasonal and year-round closures in sensitive habitat and areas where access is not necessary to monitor wildlife or maintain operations to reduce habitat impacts and invasive plant dispersal (include procedures for entering closed areas).
- Develop a spatial database to record nonnative species and their extent on the Refuge.
- Develop and implement standard operating procedures to prevent future introductions or spread of nonnative vegetation (particularly the north side of SFI and West End).
- Develop and implement a control program to reduce the impacts and spread of nonnative grasses.
- Develop and implement a control program to reduce the footprint of plantain.

Objective 2.4: Within one year of the CCP's approval, initiate annual assessment of weed management strategies by assessing percent cover and distribution of key weed species, correlating any changes in wildlife nesting that may have occurred in those areas.

Rationale: Assessing the efficacy of management actions is a common challenge for Refuge management. Recording invasive cover over the life of the CCP will be important in determining the success of the management actions, as well as correlating vegetation change to nest success.

Strategies:

- Use the weed information management system (WIMS) or other spatial tools to map vegetation management areas and track the success of management activities.
- Monitor management efforts for success of control measures and responses of seabirds, and adapt management if results are not satisfactory.
- Create experimental plots to assess the efficacy of different nonnative plant removal and revegetation techniques.
- Analyze photo-point data, plant survey data, level of effort, and other pertinent factors to prepare a report on more than 15 years of vegetation management.
- Convert the Wildlife Refuge Specialist position from a term appointment to a permanent position, with primary duties of addressing nonnative vegetation control and other habitat restoration projects.

Compatible Wildlife-Dependent Recreation

Goal 3: Increase public awareness of the marine environment and the Refuge's purposes through wildlife-dependent recreation, environmental education, and interpretation opportunities, while preserving and enhancing wildlife populations and the wilderness character of the Refuge.

Background

The 1997 Improvement Act established a mandate to facilitate wildlife-dependent public uses at refuges when compatible with the conservation of fish, wildlife, and plant resources. Wildlife-dependent uses include hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. Since the establishment of the Refuge, public access has not been permitted due to human safety issues and the sensitivity of wildlife and habitats to human disturbance. This CCP describes wildlife-dependent public use opportunities that will be provided on the Refuge consistent with the 1997 Improvement Act. Additional opportunities for on-site public use will be evaluated and developed under a visitor services plan, a Service-required step-down plan. Providing wildlife-dependent recreational opportunities will establish a human-wildlife interface that will likely enhance public understanding and support for long-term wildlife and habitat conservation on the Refuge.

Objective 3.1: Within three years of the CCP's approval, increase environmental education and interpretation interface with public charter boat companies that tour the waters near the Refuge.

Rationale: The sensitivity of the wildlife resources and the safety concerns challenge providing direct public access onto the Refuge. Instead, charter boat operators have been offering tours around the Refuge. These operators are not affiliated with the Service. Collaborating with

these operators on a regular basis would improve their interpretation to the public and facilitate outreach goals of the Refuge.

Strategies:

- Collaborate with charter boat operators, PRBO and others to develop activities and materials which will provide opportunities for charter boat customers to connect intellectually and emotionally to refuge resources.
- Develop and present a naturalist workshop(s) for Farallon charter boat operators and the staff of visitor centers that offer Farallon information or exhibits to the public (e.g., GFNMS, GGNRA, Point Reyes National Seashore [PRNS], California Academy of Sciences). Provide workshops on an annual or as-needed basis.
- Increase interface with charter boat operators by providing radio communication or other real-time interaction between island staff and the charter boats during public tours.

Objective 3.2: Beginning within five years of the CCP's approval, develop and nurture at least one new partnership project every five years that strives to increases awareness in the larger San Francisco Bay Area of the seabird and marine mammal conservation work on the Refuge.

Rationale: Environmental education is identified in the 1997 Improvement Act as a priority use for refuges when it is compatible with refuge purposes. Because the Refuge is remote and generally cannot be seen from the San Francisco shoreline, its existence and purpose are not well known. Media publications and community outreach programs will provide San Francisco Bay area residents with information on the wildlife and cultural resources on the Refuge. Refuge staff will collaborate with other stakeholders to develop interpretive products and school presentations to help meet this goal.

Strategies:

- Partner with organizations such as PRBO, GFNMS, California Ocean Communicators Alliance, and California Academy of Sciences to provide integrated education, interpretation and outreach materials in the San Francisco Bay Area (e.g., Seabird Aware brochure, ocean literacy material, and education/interpretation regarding the affects of climate change and pollution on seabird populations).
- Update Refuge brochures and develop environmental education and interpretation materials to be disseminated at partner visitor centers and other locations such as the California Academy of Sciences. These materials could be disseminated directly to the public or indirectly through docent training.
- Update website with real-time information such as sightings, column/blog, and photos.
- Install a web-camera during the seabird and marine mammal breeding seasons and make real-time observations available on the web and at various sites such as the California Academy of Sciences, PRNS, Service, or other visitor centers.
- Develop a public outreach program which includes participation at fairs, festivals, and other special events; and to targeted organizations via newsletters and sponsored events.
- Develop a media-based Refuge Centennial public outreach program.

- Develop partnerships and promote collaboration with others such as PRBO and GFNMS to provide in-classroom environmental education materials and activities for students and teachers.
- Allow up to three one- to three-person media personnel/journalist visits per year to SEFI for one- or multi-day supervised visits. These would be authorized by Special Use Permit under specific criteria and result in a published or broadcast story focused on the Refuge or its resources.

Objective 3.3: Within three years of the CCP's approval, evaluate a range of on-site activities for the public including group media tours, guided walks, and docent training (including training of docents who present Farallon material through partner organizations such as California Academy of Sciences, boat tour operators or other partners), and implement if safe and compatible.

Rationale: Wildlife-dependent recreation is identified in the 1997 Improvement Act as a priority use for refuges when it is compatible with refuge purposes. Because the Refuge is remote and generally cannot be seen from the San Francisco shoreline, its existence and purpose are not well known. The Refuge environment also makes safe access difficult; weather and equipment conditions can vary within a short timeframe, making landings even up until arrival unpredictable. In addition, refuge access requires a substantial amount of infrastructure and personnel to transfer people onto SEFI (the only island on the Refuge that where access is permitted) from the boat. These and other factors would be evaluated in the visitor services plan to determine how best to provide safe visitor activities that are compatible with the wildlife purpose.

Strategies:

- Use existing data on wildlife impacts and resource needs of current human activity on the Refuge to develop compatible public use parameters.
- Evaluate wildlife-dependent recreational activities occurring on other island refuges; collaborate with other stakeholders to research, identify, and analyze appropriate opportunities.
- Evaluate the resource and safety needs for implementing wildlife photography, wildlife observation, interpretation, and environmental education, including opportunities for docent or teacher training opportunities on the Refuge.
- Assess the opportunity to provide group media tours, implement if feasible.
- Investigate opportunities for ecotourism operators, such as existing boat tours to provide guided walking tours and evaluate potential impacts.

Other Mandates (e.g., Refuge-Specific Legislation, Executive Orders, Cultural Resources, Wilderness Areas)

Goal 4: Inventory and preserve the valuable cultural and wilderness elements of the Refuge in order to chronicle the history of the Farallon Islands and share this knowledge with the San Francisco Bay Area community and the public as a whole.

Background

Because the Refuge has experienced extensive human history, the entire SEFI was listed in the NRHP in 1977. The National Historic Preservation Act of 1966 requires federal agencies to consider the effects of their undertakings on historic properties, and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. Conducting an inventory would provide a permanent record because cultural resources on the Refuge are deteriorating under the harsh marine conditions. Also, removal of foundations and other human infrastructure that does not have historical significance is desirable from a habitat enhancement perspective. The inventory would also provide the basis for interpretation for the Refuge's outreach programs. The entire Refuge, except for SEFI, is within a congressionally designated wilderness area. This designation prohibits activities that impair wilderness characteristics.

Objective 4.1: Within five years of the CCP's approval, conduct an inventory and develop a plan to protect and interpret cultural resources on the Refuge. Use the data collected through the inventory process to refine GIS maps.

Rationale: An inventory and interpretation of presently undocumented cultural resources on the Refuge would record these resources in the event they become damaged or naturally deteriorate. In addition, reviewing these resources will help the Service prioritize preservation, maintenance, and restoration needs for these cultural elements.

Strategies:

- Work with Service cultural resource specialists to define the specific historic structures that contribute to SEFI's listing in the NRHP, and use GIS to develop these features.
- Develop a prioritized list of non-historic artificial structures/objects that need to be removed.
- Ensure that repairs of historic structures maintain the integrity of their cultural elements.
- Provide training to new Refuge personnel, interns, and volunteers on protecting and preserving cultural resources.
- Assess potential for cultural resources on the North Farallons.
- Incorporate cultural resource interpretation into public awareness program as identified under *Goal 3*.

Objective 4.2: Develop partnerships to create at least one off-refuge interpretive program that promotes the Refuge's cultural history.

Rationale: The Refuge has a rich human history that is not widely known. Interpreting the cultural resources of the Refuge would be another means of connecting the public with the remote Refuge.

Strategies:

- Utilize cultural resource assessment to develop an interpretive program for the San Francisco Bay NWR Complex and partnering visitor centers such as the California Academy of Sciences, GFNMS, GGNRA, and PRNS.
- Develop traveling interpretive displays and educational materials about the cultural resources of the Farallons for school programs and public events.

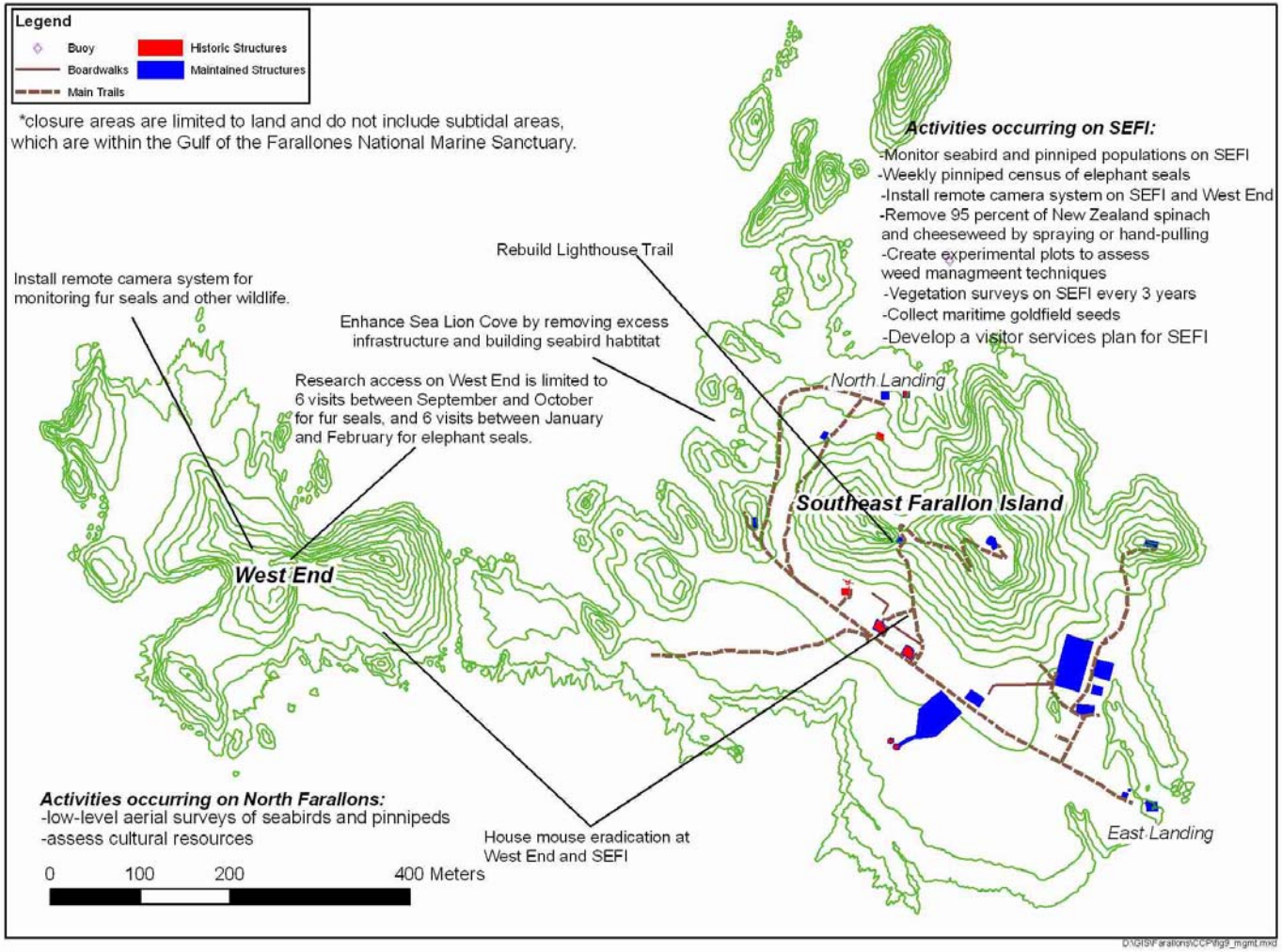
Objective 4.3: Over the 15-year life of the CCP, minimize human activities within the designated Farallon Wilderness Area to maintain its wilderness character and values.

Rationale: A substantial (141 of its 211 acres) portion of the Refuge was designated as wilderness in 1974. Motorized vehicles and mechanized equipment such as power tools are not allowed in wilderness. These areas are substantially unaffected by the imprint of human activity. Exceptions are the presence of nonnative house mice and some nonnative plants in portions of West End. Research personnel access some portions of the wilderness by foot for limited monitoring of some species. This occurs mostly on West End.

Strategies:

- Continue to monitor seabirds and pinnipeds on the North Farallons and West End by low-level aerial surveys that do not disturb wildlife.
- Avoid causing disturbance of common murres and Steller sea lions on research trips to West End by limiting interaction with wildlife, especially during sensitive pupping and fledging periods.
- Limit research access to West End to those surveys needed to assess pinniped population levels and pup numbers: six visits between September and October to assess the expanding fur seal colony, and six visits between January and February to monitor elephant seals.
- Map nonnative vegetation on the West End and develop a strategy for removal and maintenance that uses tools allowable in designated wilderness, limiting access for vegetation activities to not more than twice per year.
- Eliminate nonnative house mice on the West End using methods identified through a Minimum Requirements Decision Guide process as required under the Wilderness Act.
- Include information about Farallon Wilderness purposes in public outreach materials.
- Review and update the Farallon Wilderness Plan within five years.

Figure 11. Farallon NWR Management Activities



Chapter 6. Plan Implementation

Once the CCP has been approved and the Service has notified the public of its decision, the implementation phase of the CCP process will begin. During the next 15 years, the objectives and strategies presented in this CCP will be implemented; the CCP will serve as the primary reference document for all Refuge planning, operations, and management until it is formally revised at the end of the 15-year period. The Service will implement the final CCP with assistance from existing and new partner agencies and organizations and from the public.

CCPs provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the Service's best estimate of future needs. These plans detail program planning levels that may exceed current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. Plans do not guarantee a commitment of resources.

Activities required to accomplish the management strategies discussed in this CCP are referred to as projects. Every effort will be made to implement these projects by the deadlines established here. However, the timing of implementation of the management activities proposed in this document is contingent upon a variety of factors; these are listed below.

- Funding.
- Personnel.
- Completion of Step-Down Plans.
- Compliance with other federal regulations.
- Partnerships.
- The results of monitoring and evaluation.

Each of these factors is described briefly below.

Funding and Personnel

To implement the proposed action and to achieve the objectives and goals of this CCP, the Service will need additional funding and assess personnel needs. Needs are recorded in the Service Asset Maintenance Management System (SAMMS) and Refuge Operating Needs System (RONS) for the Refuge System. Maintenance projects under SAMMS include repair and replacement of existing buildings and facilities and removal of unneeded infrastructure. RONS projects are proposed new refuge projects that do not represent replacement of existing equipment or facilities. RONS projects for this Refuge include the addition of a permanent wildlife refuge specialist, habitat restoration projects, wildlife monitoring, and visitor services programs. It is important to note that additional projects proposed in this CCP will be added to the RONS list during the life of this CCP. An estimated $814,700 in non-salary funding is needed to implement projects in the CCP based on 2007 dollars. On average, this amounts to approximately $54,000 annually for the next 15 years. However, costs must be incrementally increased for inflation and increased activities such as new research studies.

The Refuge is managed as a satellite refuge within the San Francisco Bay NWR Complex. Staff, including maintenance, law enforcement, and refuge manager, based at the complex provide support to the Refuge. Salaries constitute a significant cost of implementing the CCP. Funding for 1.5 additional permanent staff is needed to implement the objectives and strategies of the CCP. A Wildlife Refuge Specialist permanent position is proposed to replace the existing Wildlife Refuge Specialist term position. Changing this position from term to permanent status is necessary to provide continuous management of Refuge activities and objectives as identified in the CCP. An Environmental Education Specialist is needed to develop and implement school programs, outreach to pilots and boaters, and other outreach programs. A total of $101,000 (based on 2007 salary costs) per year is needed to fund the 1.5 additional staff positions; this figure does not include salary increases over time. Table 8 describes the staffing needs for the Refuge for each project proposed by this CCP; Table 9 describes the budget proposal needed to implement the CCP.

The needs and costs shown in Table 8 and Table 9 do not entirely reflect the costs of managing the Refuge. Because of the remote location and need for constant presence, considerable funds are needed to maintain the infrastructure on SEFI. Table 10 provides a sample of maintenance needs and costs for the Refuge.

Table 8. Staffing Plan and Needs

Current Staffing Level	*Annual Estimated Costs (includes benefits)*
Refuge Manager GS-0486-12	$108,000 (2007 dollars)
Wildlife Refuge Specialist GS-485-9 (term)	$70,000
Proposed Staffing Additions	
Wildlife Refuge Specialist GS-485-9 (permanent)	$73,000
Seasonal Environmental Education Specialist GS-5/7	$28,000 (half-time)

Table 9. Budget Proposal for Farallon NWR Comprehensive Conservation Plan

Project Description	*Priority*	*Start Year*	*Completion Year*	*Duration (years)*	*Operational Cost for Startup*	*Average Annual Cost*	*Staffing (FTE)*	*RONS/SAMMS*
Restore seabird habitat, control invasive species, maintain facilities	High	Ongoing	Ongoing			$140,000	1	RONS #99502
Research and monitor wildlife, support new research needs	High	Ongoing	Ongoing			$100,000 ($25,000 annual increase)		
Provide transportation and supplies to restore habitat/maintain facilities	High	Ongoing	Ongoing			$30,000		RONS #00503
Monitor Ashy	High	n/a	n/a	2	$108,700			RONS #97501

storm-petrel population								
Investigate decline of Cassin's auklet	Medium	n/a	n/a		$60,000			
Protect, assess and monitor northern fur seal colony; public education with web camera	Medium	n/a	n/a		$50,000			n/a
Analyze results of weed control and plant monitoring to refine weed management	Medium	n/a	n/a	2	$40,000			n/a
Remove structural debris from SEFI	Medium	n/a	n/a		$210,000			EQUIP # 10104418, 10000748
Rehabilitate Lighthouse Trail	High				$67,000			EQUIP # 10000739
Media Tours					$9,000			
Environmental Education Materials	Medium					$1,000		
TOTAL					$544,700	$271,000	1	

Table 10. Sample of Maintenance Costs Associated with Farallon NWR

Description	*Estimated Cost*
Rehabilitate residence to meet fire safety requirements	$67,000
Replace 10,000-gallon water storage tank	$61,000
Rehabilitate historic USCG House	$463,000
Rehabilitate Farallon stiff-leg derrick	$100,000
Replace system water pumps and water lines	$207,000
Repair North Landing storage building	$100,000
Rehabilitate deteriorated historic rail cart system	$300,000
Repair historic carpenter-pipe shop	$150,000
Rehabilitate photovoltaic system	$160,000
Replace powerhouse roof and rehabilitate powerhouse exterior	$203,600
Replace residence heating system	$40,000
Remove old water storage tanks and water pipes	$152,000
Repair plumbing in USCG and residence buildings	$100,000

Step-Down Management Plans

Some objectives in the plan require more detailed planning than the CCP process is designed to provide. For these projects, the Service will refer to step-down management plans and other plans to provide additional details necessary to implement objectives and strategies in the CCP. A preliminary Weed Management Plan (Appendix N) was developed, but the CCP will tier off this

plan to develop an expanded vegetation management plan. This plan will provide guidance for managing native and nonnative plant communities on the Refuge for a 15-year period and for the longer term. A mouse eradication proposal was developed in 2003. It will be expanded into an EA and decision document within three years of plan implementation.

Compatibility Determination

Federal law and policy provide the direction and planning framework to protect the Refuge System from incompatible or harmful human activities and to ensure that Americans can enjoy Refuge System land and waters. The 1997 Improvement Act is the key legislation on managing public uses and compatibility.

Before activities or uses are allowed on a refuge, uses must be found to be appropriate and then compatible through a written appropriate use and compatibility determination. An appropriate use is defined as a proposed or existing use on a refuge that meets at least one of the following four conditions: 1) use is a wildlife-dependent recreational use; 2) use contributes to fulfilling the refuge purposes, Refuge System mission, or goals or objectives of the Refuge; 3) involves the take of fish and wildlife under State regulations; or 4) has been found appropriate in prior determinations. A compatible use is defined as a proposed or existing wildlife-dependent recreational use or any other use of an NWR that, based on sound professional judgment, will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the NWR. Sound professional judgment is defined as a decision that is consistent with the principles of the Service's management and administration, available science and resources, and adherence to the requirements of the 1997 Improvement Act and other applicable laws. Wildlife-dependent recreational uses may be authorized on a refuge when they are compatible and not inconsistent with public safety.

Compatibility determinations are included in Appendix J-L for research and monitoring, media access, and a real-time camera system for environmental education and monitoring.

Compliance Requirements

This CCP was developed to comply with all federal laws, executive orders, and legislative acts.

Partnership Opportunities

Volunteer efforts are critical to the achievement of Refuge objectives and strategies. The Refuge has partnered with governmental agencies, nongovernmental organizations, and individuals to conduct wildlife monitoring, habitat restoration, and facility maintenance activities. These partners play an important role in helping the Service achieve its mission and the Refuge's goals. The Service will continue to rely on these and other partners in the future to help implement this

CCP and to provide input for future CCP updates. In addition, the Service will continue to explore other potential avenues for partnerships and assistance in the monitoring and restoration of the Refuge.

Monitoring and Evaluation

This CCP is designed to be in effect for a 15-year period. The plan will be reviewed and revised as necessary to ensure that established goals and objectives are still applicable. The monitoring program will focus on issues involving habitat restoration activities, wildlife monitoring, and public use. The success of the CCP will be evaluated by the level of reduction of nonnative vegetation; the amount of habitat restored; population trends for seabirds, marine mammals, and other wildlife on the Refuge; the level of public outreach; and number of students served by the environmental education program at schools. Collection of population data on the seabird and marine mammal populations will continue. These data will be used to update existing species inventories and modify management of habitat areas. Other wildlife will be observed and included in the annual reports as appropriate. Permanent vegetation transects, plots, and photo points have been used to assess changes and trends in the native and non-native plants over time. Plant monitoring will continue and new monitoring plots may be added to judge efficacy of restoration projects. Specific monitoring strategies have been integrated into the goals and objectives; details are provided in Table 11.

Table 11. Monitoring Methods

Study Variable	*Monitoring Methods*
Seabird and pinniped colonies	Counts of individuals, active nests, and/or chicks/pups during the breeding season will be conducted annually or more frequently, as needed, for 11 seabird and five marine mammal species. Surveys are conducted by trained PRBO staff and interns through a Cooperative Agreement. The survey requires access to SFI. Observations at other parts of the Refuge are conducted by boat to reduce disturbance to wildlife. Adults, chicks, and eggs are counted when visible. The data collected are provided in the form of monthly and annual reports to the Service. Petrel and auklet populations will be monitored closely concurrent with the house mouse eradication plan and the take of individual problem gulls.
Other wildlife	Conduct annual surveys of salamanders, bats, landbirds, insects, and other wildlife. Burrowing owls will be monitored in response to rodent removal. Mice populations will be also monitored to determine the effectiveness of the eradication.
Effects of nonnative vegetation control measures	Large areas of nonnative vegetation will be mapped and the data stored in the Refuge Lands or other spatial GIS databases. Areas where control activities are planned or conducted will be also be mapped. Changes in plant cover will be monitored by established transects, plots, photo points, and by GPS using cover classes.
Survival of planted native seeds	Native plantings will be assigned a plot area. Survivorship and percent cover of native plantings will be monitored annually for at least 3 years. Percent survival will be estimated visually. Data will be entered into a Refuge GIS database.
Excess infrastructure	Inventory items removed from or reused on the Refuge.
Number of wildlife	Record and report the number of boating and aircraft violations. Observe if

disturbance violations	violations cause wildlife disturbance.
Off-site wildlife-dependent observation and photography	Record the number of tours (including number of people) visiting the waters off the Refuge; track number of participants in naturalist workshops; and track number of journalists (and compile articles written) participating in media tours.
Environmental education and interpretation	Record the number of outreach events attended and number of people served by each event. Record the number of hits on the website.
Environmental education program at schools	Record the number of schools, classrooms, and students participating in the program.
On-site wildlife dependent recreation	Record number of visitors to the Refuge, providing comments cards to measure their experience. Monitor wildlife and habitat impacts from visitor use.

Adaptive Management

Adaptive management is characterized by management that monitors the results of policies and/or management actions and integrates this new information, adjusting policy and management actions as necessary (Jacobson 2003). Adaptive management promotes flexible, effective decision making that can be adjusted in the face of uncertainties as outcomes of management actions and other events become better understood. Careful monitoring of these outcomes both advances understanding of the system and helps adjust policies. Adaptive management incorporates natural variability in evaluating ecological resilience and productivity (Trulio and Clark 2005).

Adaptive management provides the framework within which biological measures and public use can be evaluated by comparing the results of management to the expected results of objectives. Under the CCP, habitat, wildlife, and public use management techniques and specific objectives would be regularly evaluated as the results of monitoring programs, as well as new technology and other information, become available. These periodic evaluations would be used over time to adapt both the management objectives and the strategies to better achieve management goals. Such a system embraces uncertainty, reduces option foreclosure, and provides new information for future decision making while allowing resource use. The management scenario proposed in this CCP provides for ongoing adaptive management of the Refuge. The CCP may be amended as necessary at any time in keeping with the adaptive management strategy. However, any major changes to the CCP may require additional NEPA documentation and public involvement processes.

Plan Amendment and Revision

The CCP is intended to evolve as the Refuge changes; to this end, the 1997 Improvement Act specifically requires that CCPs be formally revised and updated at least every 15 years. The formal revision process would follow the same steps as the CCP creation process. In the meantime, the Service will review and update this CCP periodically if needed, based on the results of the adaptive management program. While preparing annual work plans and updating the Refuge database, Refuge staff will also review the CCP. It may also be reviewed during routine

inspections or programmatic evaluations. Results of any or all of these reviews may indicate a need to modify the plan. The goals described in this CCP would not change until they are reevaluated as part of the formal CCP revision process. However, the objectives and strategies may be revised to better address changing circumstances or to take advantage of increased knowledge of the resources on the Refuge. It is the intent of the Service that this CCP apply to any new lands that may be acquired. If changes are needed, the Refuge manager will determine the appropriate public involvement and associated NEPA documentation.

The intent of the CCP is for progress toward and/or achievement of Refuge objectives during the lifetime of the plan. Management activities would be phased in over time, and implementation is contingent upon and subject to the results of monitoring and evaluation, funding through Congressional appropriations and other sources, and staffing.