**Conservation Action Plan for**

**Ashy Storm-Petrels (*Oceanodroma homochroa*)**

**in California and Baja California**

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Ashy storm-petrel (*Oceanodrama homochroa*) at-sea. Photo by D. Pereksta. Used with permission.

**DRAFT FINAL PLAN (August 2016)**

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# Executive Summary

**Current Species Status**

The ashy storm-petrel (*Oceanodrama homochroa*) is a relatively rare seabird that is endemic to the California Current System. The global breeding population is only roughly known and is thought to be nearly 5,000 breeding pairs. At-sea population estimates place the global population between 10,000 and 20,000 birds. However, both breeding and global population estimates are based on dated information and represent significant data gaps for this species.

The species is considered endangered and declining by the International Union for the Conservation of Nature (IUCN 2015). In Mexico it has been listed at the federal level as threatened. The U.S. Fish and Wildlife Service completed status reviews, in 2009 and 2013, to evaluate its potential listing under the U.S. Endangered Species Act but ruled that “listing the ashy storm-petrel is not warranted at this time” (USFWS 2013). The State of California has not considered it for listing under the California Endangered Species Act but does consider it a “Species of Special Concern”.

**Current Conservation Concerns and Threats**

In addition to the need for updated information on population estimates and trends, several threats have been identified that are likely impacting populations. Predation by avian and mammalian predators appears to be a key limiting factor at several breeding colonies including at the South Farallon Islands, Channel Islands (e.g. Santa Cruz, Santa Barbara, San Miguel, and San Clemente) and Todos Santos Islands. Most of the predation issues are site-specific and comprise relatively complex predator-prey relationships as well as socio-political issues. Thoughtful conservation actions need to be considered at each location in order to address predation concerns that have been identified. In addition to predation, other potential threats include human presence at breeding colonies (recreationists, military activities, and researcher activities), lack of bio-security plan implementation, climate change, oil and organocholorine pollution, impacts from artificial lights, impacts from introduced non-native vegetation, and ingestion of plastics. Furthermore, impacts from wind energy farms, proposed for development off the California coast, have potential to impact ashy storm-petrel populations.

**Conservation Strategy and Goals**

The conservation strategy to ensure the long-term viability of the ashy storm-petrel focuses on four areas of concentration:

* establishment of an index monitoring program range-wide;
* reduction of predation at breeding colonies, as appropriate;
* utilization of artificial nest structures and habitat improvements to maintain viable populations, as appropriate;
* conducting surveys and research to: (a) identify breeding locations, (b) determine population size(s) and breeding/non-breeding bird ratios, (c) determine movements and relationships between colonies (d) identify information gaps and additional conservation issues.

The goals for each of these 4 areas are:

## Index Monitoring Program Goal: Create and implement a range-wide monitoring program that will provide for the detection of “biologically significant” trends in population parameters (e.g., population size, breeding success, adult survival) and place an emphasis on attributes of sampling design (e.g., randomization, bias, detection probability) and the level of precision.

## Artificial Habitat/Nest Structures Goal: As appropriate, provide and maintain artificial habitat and/or nest structures at breeding colonies to aid in the long-term survival of the ashy storm-petrel (and other storm-petrel species, e.g., Leach’s storm-petrel, black storm-petrel Oceanodroma melania) colonies through increased nesting habitat availability, increased nesting success, or increased adult survival by reducing the risk of predation at the nest site.

## Reduction of Predation at Breeding Colonies Goal: Reduce predation by avian and mammalian predators to a low level as to eliminate predation as a significant risk to the continued survival of ASSP breeding colonies.

## Survey and Research Goal: Develop and conduct research activities to fill information gaps on known and potential threats as well as enhance the overall understanding of conservation actions necessary for the continued existence of ashy storm-petrel.

**Important Conservation Actions**

This conservation action plan identifies important conservation actions (i.e., objectives) that the ashy storm-petrel working group determined were important to be implemented in the next 5 to 10 years for the long-term viability of the species. Objectives were ranked when ashy storm-petrel experts were asked to cast from 0-5 votes for each objective identified in the plan, with 30 votes allocated to each expert (Appendix 1). At total of 19 individuals voted. The highest priority objectives identified were:

1. Within the next 5 years of the completion of this plan, complete the permitting process (e.g., EIS, etc.) and begin implementing identified methods to eradicate invasive, introduced house mouse from the South Farallon Islands in order to eliminate their negative impacts to ashy storm-petrel and other native species of the Farallon National Wildlife Refuge.
2. Within 3 years of this plan, an ashy storm-petrel monitoring working group will develop an ashy storm-petrel monitoring plan.
3. Within 5 years of the completion of this plan, investigate the feasibility of conducing black rat (*Rattus rattus*) eradication on San Miguel Island. When feasible, begin rat eradication from San Miguel Island using the most appropriate and cost effective methods.
4. At appropriate ashy storm-petrel nesting locations, with documented predation issues, CINP and its cooperators will maintain avian predator proof artificial nest sites in order to increase the availability of protected nest sites and reduce the percentage of ashy storm-petrel nest sites (adults, eggs, and chicks) vulnerability to avian predation.

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# Section I. Introduction and Background: Need For A Conservation Plan

The ashy storm-petrel (*Oceanodrama homochroa*) (hereafter ASSP) is a relatively rare seabird (<10,000 breeding pairs), with a restricted breeding range almost entirely in California (Ainley et al. 1990; Carter et al. 2008a; Ainley 1995). The largest known colony at the South Farallon Islands (hereafter “Farallones”, composed of a group of islets) was first estimated at ~1,500 - 2,000 pairs in 1959 and 1971-72 (Ainley and Lewis 1974). Most of the colony occurs on Southeast Farallon Island, since 1969 included within the Farallon National Wildlife Refuge (managed by the U.S. Fish and Wildlife Service). The next largest colonies at Prince Island (~300 pairs) and Santa Barbara Island (~150 pairs; including Sutil Island) were not surveyed until 1975-1977 (Hunt et al. 1979). Santa Barbara Island has been part of the Channel Islands National Monument (managed by the National Park Service), when formed in 1933. Prince Island had been managed by the U.S. Navy since 1934. Both islands were subsequently included in Channel Islands National Park when the Park was created in 1980. By the 1980s, all three major colonies (Farallones, Prince Island and Santa Barbara/Sutil islands) were protected in federal public ownership and introduced predators (primarily feral cats *Felis catus*) had been removed from the Farallones and Santa Barbara Island. As a result of these land protections and conservation actions, ASSP populations appeared to be secure by the 1980s, though still considered from a world-wide view of seabird species to be a relatively rare seabird. In response, the California Department of Fish and Wildlife (formerly California Department of Fish and Game) has designated it a Species of Special Concern (Remsen 1978).

Concerns for the conservation of ASSP were heightened in the 1990s based on studies indicating the species was in decline and faced major new threats, despite the legal protection of major colonies. Sydeman et al. (1998) documented a 44% decline in the population size at the Farallones in 1992 compared to 1971-72 based on a comparison of mist-net captures, and updated the population estimate to ~995 pairs. The cause of this decline was attributed to relatively high predation by an expanded breeding population of western gulls (*Larus occidentalis*) and seasonally resident burrowing owls (*Athene cunicularia*). The owls are encouraged to remain longer than otherwise on the islands owing to an infestation of non-native house mouse (*Mus musculus*; Mills 2016). More recently, Joyce et al. (2016; Pacific Seabird Group presentation) noted no change in the total world population of ASSP, based on analysis of at-sea survey data, 1988-2004; although it is unknown if this reflects a reduced world-wide population from what is assumed to be a larger population in the early 1970s. Furthermore, in a detailed seabird survey throughout California,1989-1991, Carter et al. (1992) reported higher estimates of ASSP at Santa Barbara Island (~730 pairs, including Sutil Island), and Prince Island (~577 pairs) than previous reports, apparently the result of increased survey effort (Carter et al. 1992). Additional colonies also were discovered in 1994-1996 in the Channel Islands, especially Santa Cruz Island (see summary in Carter et al. 2016a). Based on the best available information during the late 1990s, including the ~995 breeding pair estimate for the Farallones, ~38% of the global population of ASSP would have been known to nest on the Farallones as compared to the 85% estimate (~7,000 individuals) reported in Ainley & Boekelheide et al. (1990), the 55% estimated by Carter et al. (1992) and the 50% to 70% reported by Sydeman et al. (1998).

Despite larger population size estimates in the Channel Islands in 1991-1996, concern for ASSP increased greatly when high levels of organochlorine pollutants (DDTs and PCBs) were found in eggs from Santa Cruz Island in 1992-1997 and impacted nesting success (Fry 1994; Kiff 1994; Carter et al. 2008a, b; McIver et al. 2009). Non-native as well as native mammals in the Channel Islands, as well as bright lights from squid fishing vessels, were also identified as a problem for ASSP (McIver et al. 2016; Carter et al. 2016a). Ainley and Hyrenbach (2010) provided further evidence that the global population was declining as their at-sea estimates of ASSP declined 76% from 1985-1994 to 1997-2006. In short, by the early 21st century the best available science indicated that major factors threatened the viability of the species.

As a result of major threats and a suspected decline in ASSP populations, several changes in status and management actions have occurred since 2000:

**2001** – The International Union for the Conservation of Nature (IUCN) designated ASSP as endangered and declining on its Red List (version 3.1).

**2001-2002**– The eradication of black rats (*Rattus rattus*) from Anacapa Island is conducted. This is expected to aid nesting ASSP; as well as other seabirds breeding on Anacapa Island.

**2002** – The U.S. Fish and Wildlife Service listed ASSP as a Bird of Conservation Concern (USFWS 2002).

**2005** – The U.S. Fish and Wildlife Service identified the ASSP as “highly imperiled” in its Pacific Region Seabird Conservation Plan (USFWS 2005). Restoration of ASSP was included in the Montrose Settlements Restoration Program (MSRP 2005).

**2006** – The National Audubon Society included ASSP as one of the 10 most endangered birds in the United States (National Audubon Society 2006).

**2007** – The Center for Biological Diversity petitioned the U.S. Fish and Wildlife Service to list the ASSP as threatened or endangered pursuant to the Endangered Species Act (Wolf 2007).

**2008** – The California Department of Fish and Wildlife released their updated list of Bird Species of Special Concern, which again included ASSP but with an elevated priority 2 (Carter et al. 2008a). Restoration actions were initiated at Santa Cruz Island (McIver et al. 2016).

**2009** – The U.S. Fish and Wildlife Service announced a 12-month finding of “not warranted at this time” for listing the ASSP under the Endangered Species Act (USFWS 2009a).

**2010** – The ASSP is listed as “endangered” under Mexican Law, NOM-059-SEMARNAT-2010 (SEMARNAT 2010).

**2012-2014** – Audubon California hosted meetings of ASSP experts and management agencies to discuss range-wide monitoring and conservation efforts.

**2013** – The U.S. Fish and Wildlife Service announced a second 12-month finding of “not warranted at this time” for listing the ASSP under the Endangered Species Act (USFWS 2013a). This second examination of the status of the species had been conducted by the U.S. Fish and Wildlife Service as part of a settlement agreement with the Center for Biological Diversity.

**2015** – A special paper session on ASSP was hosted at the Pacific Seabird Group meeting in San Jose, California. Several papers from this session are published, as a special section, in the scientific journal *Marine Ornithology* (see Carter et al. 2016a introducing this section). This special paper session aided in providing land managers and others interested in the conservation of ASSP with some of the latest science and information about the species.

Based on the limited population size, restricted breeding range and ongoing threats, improved conservation and monitoring efforts are still needed for this rare species.

## Purpose

The three main purposes of this plan are:

1. to provide a framework for future conservation actions that will reduce threats to the ASSP population and help ensure its long-term viability and retention of breeding colonies throughout its current range;
2. to assist management and funding decisions by government agencies within the U.S. and Mexico as well as provide useful information to conservation organizations (e.g., NFWF, California Audubon, GECI); and
3. to foster the creation of an ASSP Working Group that will coordinate research, monitoring and conservation activities.

This conservation plan focuses on four areas that have been identified by management agencies and ASSP experts including:

* establishment of an index monitoring program range-wide;
* reduction of predation at breeding colonies, as appropriate;
* conducting surveys and research to: (a) identify breeding locations, (b) determine population size(s) and breeding/non-breeding bird ratios, (c) determine movements and relationships between colonies (d) identify information gaps and additional conservation issues; and
* utilizing artificial nest structures and habitat improvements to maintain viable populations, as appropriate.

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Nesting ashy storm-petrel (*Oceanodrama homochroa*).

Photo by D. Pereksta. Used with permission.

# Section II. Ashy Storm-Petrel Species Account

## Life History

### Breeding Habitats

Most of the ASSP colonies on offshore islands and nearshore rocks are present in largely xeric locations. ASSP do not excavate burrows; rather, they are known to nest within rock crevices, formed among the talus and rocky slopes, rock walls (natural and man-made), sea caves and driftwood that occur on various offshore islands, islets and coastal rocks (James-Veitch 1970; Ainley et al. 1990; Ainley 1995; McIver 2002; Carter et al. 2008a; Carter et al. 2015; McIver et al. 2009a; McIver et al. 2016a). At the largest known colony at the Farallones, a large proportion also breeds in human-modified talus slopes and human-built rock walls developed after 1800 (Ainley et al. 1990; Carter et al. 2008a, 2016a). At Prince Island, natural habitats likely have been modified due to commercial guano harvesting as well as by bombing practice by the U.S. Navy (San Francisco Call 1895; Carter et al. 2008c). At Bat Cave, the largest sea cave colony at Santa Cruz Island, many nests are found within piles of driftwood inside the cave (McIver 2002). ASSP also nest in cliffs on offshore islands, nearshore rocks and mainland cliffs, based on work conducted by Hunt et al. (1979) at Sutil Island, calls being detected from small crevices in cliffs on Santa Barbara Island (G. McChesney, pers. comm.) and mist-net captures near cliff habitats (e.g., Point Reyes Headlands, Becker et al. 2016; Santa Cruz Island, D. Mazurkiewicz, pers. comm.; Brown et al. 2003). However, much of the cliff-type terrain precludes access by researchers and documentation of ASSP nesting in cliff habitats is limited. Nesting on islands and islets is considered, in general, to be an adaptation among seabirds to prevent or greatly reduce mammalian predation. However, islands and rocks are still accessible to avian predators (e.g., in the case of ASSP: common ravens (*Corvus corax*), burrowing owls, barn owls (*Tyto alba)* and western gulls) (Sydeman et al. 1998; McIver 2002; McIver et al. 2016), and, in general, seabird activity out of cavities only at night, is considered to be a deterrent to avian predation. Nearshore islets are likely accessible by some mammalian predators (e.g., river otters *Lontra* c*anadensis*) while some offshore island and islets have native mammalian predators (e.g., Channel Islands: island spotted skunks *Spilogale gracilis amphiaia*, island foxes *Urocyon littoralis*, deer mice *Peromyscus maniculatus*) and introduced non-native mammals (e.g., Farallon Islands: house mouse; San Miguel Island and San Clemente Island: black rats). River otter populations have expanded in central California (Bouley et al. 2015) and been observed at storm-petrel nesting sites at Point Reyes National Seashore (B. Becker, pers. comm.) and suspected of depredating ASSP adults at Franklin Smith Rock (Carter et al. 2015). Both mammalian and avian predators are known to prey on adults, eggs, and chicks (Ainley et al. 1990; McIver 2002; McIver et al. 2009a; McIver et al. 2016).

Throughout the breeding range, natural breeding habitats are relatively stable, with little substantial change between years. However, erosion of coastal islands (from water, wind and earthquakes) does occur over time with either the creation of small sections of new habitat (through rockfall crevices), and loss of small sections of habitat, especially in sea caves and offshore rocks. For instance, during an intense deluge on the normally somewhat xeric South Farallon Island during El Niño, in 1983, a large cascade of rocks washed down the talus slopes changing ASSP nesting habitat (D. Ainley, pers. comm.). The loss or creation of habitat from different forms of natural erosion has not been well studied but seems unlikely to be a major impact on the status of ASSP in the next 10-15 years, especially as global climate change seems to be reducing rainfall in California.

Global climate change, however, is bringing rising sea levels (IPCC 2014) with noticeable increase already. High-water and large wave events have recently impacted nesting habitats in certain sea caves and offshore rocks, by changing driftwood configurations or moving smaller rocks and boulders that provide nesting habitat, resulting in loss or temporary flooding of breeding habitats (McIver et al. 2016b). Low-lying nesting habitats, in sea caves and some nearshore rocks, are at risk of being impacted by sea-level rise and high-water and large wave events. As sea-levels increase, these low-lying nesting areas may become unavailable to ASSP. However, wave events, likely from winter storms, have washed large amounts of driftwood and other debris into sea caves (e.g., Bat Cave) and thus have also created nesting habitat utilized by ASSP (W. McIver, pers. comm.).

Photo to be inserted

Ashy storm-petrel on a nest in Cave of the Birds Eggs, Santa Cruz Island.

Photo by W. McIver. Used with Permission.

### Timing of Breeding

The breeding season is protracted and ASSP visit breeding colonies year-round, although visitation is most frequent from February through October based on data collected at the Farallones (James-Veitch 1970; Ainley et al. 1974, 1990). Visitations can be divided into three general periods: pre-egg, incubation and chick-rearing. ASSP begin visiting breeding colonies in late December and courtship or maintenance of sites can last up to 3 months (Ainley 1995; Ainley et al. 1990). Egg-laying is asynchronous and extends from early April through October with most egg-laying in late June or early July (James-Veitch 1970; Ainley et al. 1990; McIver 2002). Clutch size is one egg and parents alternate incubation duties every 1-8 days (average 2-3 days) during an average incubation period of about 45 days, ranging 42 to 59 days (Ainley 1995). Replacement eggs are sometimes laid after failure of a first egg (Ainley et al. 1990; McIver 2002). Once hatched, a nestling is brooded for approximately 5 days, after which the nestling remains at the nest site alone during the day (Ainley et al. 1990). Nestlings are fed irregularly, an average of about once every 1 to 3 nights, during brief parental visits. ASSP chicks fledge at an average age of 85 days, but ranging 72 to 119 days (Ainley et al. 1990). Most fledging occurs between late September and late October but some chicks fledge as early as June and as late as January in some years (Ainley et al. 1990; McIver 2002).

### Diet

While the diet of ASSP has not been well-studied, it likely includes euphausiids (e.g., *Euphausia pacifica*, *Thysanoessa spinifera*) and other crustaceans (including the young of spiny lobsters *Panulirus interrtuptus*), fish eggs, larval and small fish and squid, all taken at the ocean’s surface (Anthony 1898; McChesney 1988; Ainley 1995, Carter et al. 2008a). High-lipid prey items likely make the ASSP susceptible to bioaccumulation and/or biomagnification of compounds and elements contained in the prey. Fry (1994) suspected that high-lipid prey items may have been the sources of high levels of organochlorine residues found in ASSP eggs collected in the Channel Islands. In addition, plastic particles, including nurdles, have been found in storm-petrel species that forage in the California Current (Blight & Burger 1997; Schuiteman 2006). Similar plastic pellets collected from beaches around the world have been shown to contain PCBs and organochlorine pesticides and ingestion by storm-petrels represents an additional pathway for these toxins to be absorbed by storm-petrels (Mato et al. 2001). Moreover, storm-petrels with high loads of plastic in their guts are also of low body mass and condition (Spear et al. 1995).

**At-sea Distribution**

ASSP are known to forage along the continental slope in waters of central and southern portions of the California Current System between northern California and central west Baja California, based on information from extensive at-sea surveys, telemetry studies and pelagic birding trips (Figure 1; Stallcup 1976; Briggs et al. 1987; Ainley 1995; Howell & Webb 1995; Mason et al. 2007; Spear & Ainley 2007; Adams & Takekawa 2008; Ainley & Hyrenbach 2010; Howell 2012). They primarily occur in waters seaward of the continental shelf break (over the continental slope where depths are 200 – 2000 m), within range of offshore islands colonies, and closer to the coast within the southern parts of its range. ASSP are non-migratory and exhibit little post-breeding dispersal (Ainley 1995; Adams & Takekawa 2008). Off southern California, concentrations of ASSP have been recorded in 3 main areas: the continental slope SW of Point Buchon, western Santa Barbara Channel and in the Santa Cruz Basin area (Briggs et al. 1984; Mason et al. 2007; Adams & Takekawa 2008). Off northern California, ASSP concentrations occur along the continental slope west of the Farallones, over the Cordell Bank and in Monterey Bay (Briggs et al. 1984; Ainley et al. 1990; Allen 1994; NOAA 2003, 2007; Spear & Ainley 2007). Anecdotal information from pelagic birding trips indicates that some ASSP “hotspots” in this region have shifted. For example, a major late summer and fall hotspot over the Monterey Submarine Canyon (~36.5° N) which had been known since the 1970s appears to have shifted to the Cordell Bank area (~38° N) sometime in the early 2000s (D. Shearwater, pers. comm.).

At-sea distribution and seasons of occurrence of ASSP at the northern and southern extremes of the range are less well known but existing data have yet to be analyzed. ASSP have been observed as far north as latitude 47° N (off the coast of Westport, Washington) on two occasions in 2006 and 2008 (Washington Ornithological Society, http://wos.org/documents/WBRC/wbrcaccepteddec2014.pdf, accessed October 19, 2015). To date, six sightings of single or small numbers of birds (<10) have been accepted by the Oregon Bird Records Committee since 2007 with 4 of the 6 sightings occurring in 2014 (Oregon Birding Association, http://www.orbirds.org/obrcrecordsmay2015.pdf , accessed October 19, 2015). At-sea observations of ASSP south of the San Benito Islands, Mexico (latitude 28° N) appear to be unusual, based on the few at-sea surveys that have been conducted in this region (Spear and Ainley 2007; D. Ainley, pers. comm.).

### Colony Distribution

ASSP have been confirmed to breed at 32 locations between Point Cabrillo, Mendocino County, California, south to the Todos Santos Islands, Baja California, Mexico (Table 1; Figures 2-6)(Everett & Anderson 1991; Carter et al. 2008a, 2015, 2016a). Breeding at Todos Santos Islands was first determined from a single nest found in 2005 (Carter et al. 2006a, 2008a) but recently the species identification of this nest had been questioned (Carter et al. 2016a). However, 17 ASSP nests were found at Todos Santos Islands during the 2015 breeding season using vocalizations and in-hand identification for species confirmation, thus this is a confirmed and active ASSP breeding colony (Bedolla-Guzmán, GECI, unpublished data). More detailed work is needed to differentiate what storm-petrel species actually nests, and in what proportion, among the various Channel and Mexican islands (Adams et al. 2016; H. Carter, pers. comm.; Y. Bedolla-Guzmán, pers. comm.).

Twenty-six ASSP nesting locations (n=32) are managed by U.S. federal agencies, including the National Park Service (11 nesting locations in Channel Islands National Park; 2 nesting locations in Point Reyes National Seashore), Bureau of Land Management (9 nesting locations in the California Coastal National Monument), U.S. Navy (3 nesting locations: 2 locations at San Miguel Island on Castle Rock and Prince Island, 1 nesting location at San Clemente Island) and U.S. Fish and Wildlife Service (1 location at the Farallon National Wildlife Refuge). The National Park Service also co-manages San Miguel and Santa Cruz islands with the U.S. Navy and The Nature Conservancy, respectively. The U.S. Navy is a stewardship partner for the islets adjacent to San Clemente Island owned by Bureau of Land Management as part of the California Coastal National Monument. A non-governmental organization (i.e., The Nature Conservancy) owns and manages 4 locations at western Santa Cruz Island. The government of Mexico owns and manages 2 nesting location at Todos Santos Islands.

## Breeding Colony and Population Estimates

Obtaining direct counts of all ASSP nests at breeding islands or rocks is extremely difficult, as is true with most crevice- or burrow-nesting seabird species. Moreover, confounding estimates of breeding numbers is the possible presence of a ‘floating population’ of adults not breeding owing to being denied access to suitable nesting cavities or for other unknown reasons. Floating populations are a characteristic of some cavity-nesting seabirds (e.g., Cassin’s Auklets *Ptychoramphus aleuticus* at the Farallon Islands – see Manuwal 1974) and Ainley and Boekelheide (1990) present information that suggests competition for nest sites may exist for ASSP at the Farallones (see Ainley and Boekelheide 1990 pages 149 and 374 for details). However, current data and information from the Farallones and Channel Islands does not appear to support the theory of competition for nest sites or habitat limitation for ASSP (R. Bradley, pers. comm.; W. McIver, pers. comm.; D. Mazurkiewicz, pers. comm.; Point Blue, unpubl. data). Regardless, the presence of non-breeding birds, whether immature or breeding age, increases the difficulty in estimating populations accurately.

Breeding population estimates of ASSP in California have been determined through two primary methods:

1. capture-recapture analyses; uses data collected on 2 or more nights per month of mist-netting (usually with vocalization luring) of adults and subadults from April to August at the largest colony at the Farallones (1,001-5,000 pairs; Ainley & Lewis 1974; Sydeman et al. 1998; Bradley 2011, Nur et al., in review), certain medium-sized colonies (101-1,000 pairs) at Prince Island, Sutil Island and Santa Barbara Island (Hunt et al. 1979; Carter et al. 1992), and certain small colonies such as South Cove Seal Rock off of San Clemente Island (Carter & Henderson 2015, 2016). The main advantages of this method at these locations are that most habitat is not accessible to humans during the breeding season, a population estimate can be derived using a standardized method, other simultaneously collected documents presence and relative abundance (e.g., capture rates), and vital population variables can be estimated with long-term capture studies (e.g., adult survival rates). The main drawbacks are that data collection is relatively labor intensive and limited to good weather conditions, nightly capture rates and colony attendance are variable, birds may avoid recapture, adults are difficult to distinguish from subadults based on brood patch development, analyses involve assumptions that are violated or cannot be validated, and the accuracy of estimates is difficult to determine; the existence of any floating population is difficult to verify and quantify; and
2. direct counts of nests at some small colonies (<100 pairs) and certain medium-sized colonies (101-1,001 pairs) at largely accessible rocks and sea caves (e.g., Bird Rock, Stormy Stack, Orizaba Rock and Santa Cruz Island sea caves; Becker et al. 2016, McIver et al. 2016a). The main value of using this method at these small- to medium-sized colonies is that the raw total count, if available nesting habitat is completely surveyed, can be close to the actual number of nests (if the raw total count occurs after most egg laying and before fledging, accounts for failed nests, and few or no nests are inaccessible), a standardized population estimate can be derived, estimates can be based on the raw count or with an adjustment for inaccessible habitats if needed to better indicate approximate colony size, the accuracy of these types of estimates is relatively high and defensible, and other information can be simultaneously gathered (e.g., reproductive success and predation rates). The main drawbacks of this method is that eggs are laid asynchronously and colonies should be visited monthly (or more frequently) during the breeding season to determine total nest counts and account for failed nests, and the assumption has to be made that nest density is constant and can be applied to habitat that cannot be surveyed. This method is also relatively labor intensive and, as noted in certain crevice habitats, inaccessible nest sites make obtaining a complete count difficult.

In addition, various other methods have been used for certain small colonies to obtain rough estimates of population size, such as counting suitable crevices in accessible habitats and adjusting with a correction factor for occupancy, finding a few nests and extrapolating for areas not searched, or conducting one night of mist-netting for determining capture rate then making a rough adjustment based on habitat available to estimate colony size (Hunt et al. 1979; Carter et al. 1992).

World breeding population estimates of ASSP have been determined through summing colony estimates. Sowls et al. (1980) estimated 5,187 breeding ASSP (~2,590 pairs) in California, based on data gathered at 9 colonies in 1975-1980 and substituting past estimates for 2 colonies (including 2,000 nests at the Farallones in 1972 and 100 nests at Castle Rock in 1968). Carter et al. (1992) updated this estimate to 7,209 birds (~3,600 pairs), based on data gathered at 7 colonies in 1989-1991 and substituting past estimates for 5 colonies (again including the Farallones and Castle Rock). However, in 1992, the Farallon estimate was revised from ~2,000 pairs to ~995 pairs (Sydeman et al. 1998). Using this 1992 value, the California breeding population size in 1989-1992 was 5,199 birds (~2,600 pairs). Approximately 99% of the population bred on 4 island groups: South Farallon Islands (38%), Santa Barbara Island (28%), San Miguel Island (26%), and Santa Cruz Island (6%). These past estimates do not include any birds breeding in Baja California, Mexico but only a few birds have been confirmed to breed there. Thus, California and world breeding population sizes are nearly the same.

Table 1 provides the most recent and best available estimates of numbers of breeding ASSP at all documented breeding locations in California and Baja California Norte. A majority of these data do not have confidence intervals or ranges available for them in the reference materials. Most importantly, a recent updated population estimate is available from the Farallones in 2010-2012 (Nur et al. 2013) and recent estimates are available for several small colonies in Mendocino County (Carter et al. 2015), Point Reyes National Seashore (Becker et al. 2016), and Santa Cruz Island (McIver et al. 2016, unpubl. data; H. Carter unpubl. data). However, most recent breeding population estimates for the largest colonies in the Channel Islands at Prince Island and Santa Barbara Island (including Sutil Island) were determined over two decades ago in 1991 and certain small colonies have not been re-estimated since 1968 (Castle Rock), 1977 (Gull Island), and 1991 (Diablo Rocks, Willow Anchorage Rocks, and Scorpion Rocks). ASSP mist-netting has been conducted in 2004-2007 and 2014-2015 at Santa Barbara Island, Prince Island and Scorpion Rock (adjacent to Santa Cruz Island), however these data have not been utilized to calculate breeding population estimates for these locations (Adams 2015; D. Mazurkiewicz, pers. comm.; also see Russell et al. for discussion on issues of using capture/recapture methodology to obtain ASSP population estimates). In addition, insufficient effort has been expended to obtain estimates of small numbers breeding at Anacapa Island (Harvey et al. 2016). Prior to 2013, insufficient effort had been expended to obtain estimates of small numbers breeding at the Coronado Islands in Baja California; however since then GECI has conducted yearly monitoring, nest searches in suitable habitat, preformed spot-light surveys, and utilized automated audio-recording units without finding ASSP nests. Moreover, it was recently discovered that the ASSP at Santa Catalina Island were actually Leach’s storm-petrel (*Oceanodroma leucorhoa*) (Carter et al. 2016b), an issue that likely needs to be addressed at other Channel Islands.

For this plan, we have summed these “most-recent” estimates to obtain a total breeding population of 4,679 pairs (9,538 breeding individuals). Based on this estimate, approximately 96% of the population breeds at 4 island groups: South Farallon Islands (60%), Santa Barbara Island (15%), San Miguel Island (14%), and Santa Cruz Island (7%). Caution should be taken when reviewing this summary of colony estimates as these estimates may not be an accurate reflection of the true proportions of the current breeding populations at these four island groups because:

1. mist-net based population estimates utilized at the three largest island populations have not been validated;
2. large population fluctuations have occurred at the Farallones over time, based on best available data; and
3. estimates from Santa Barbara Island and San Miguel Island from 1991 are outdated and have no confidence intervals or ranges associated with them.

Despite the quality of these data, it is likely that the vast majority of the world breeding population nests at these four island groups. Based on these data alone, it seems reasonable to consider that roughly half of the world population breeds at the Farallones and half at three Channel Islands (Santa Barbara, San Miguel, and Santa Cruz). However, it appears that there is a “mismatch” between at-sea numbers and island population estimates; Farallones versus central California waters and Channel Islands versus southern California waters. This hypothesis is based on greater numbers of ASSP being counted at-sea in the northern portion of the range (nearer the Farallones) and in similar numbers to breeding estimates at the Farallones as compared to fewer ASSP counted at-sea in the southern portion of the range (nearer to the Channel Islands) and in lower numbers than the estimated breeding population at the Channel Islands (D. Ainley, pers. comm.). Thus, the at-sea survey numbers do not support the colony-based data that roughly half of the ASSP population is breeding in the Channel Islands area. Possible explanations for the observed “mismatch” are: a) the Farallon/Northern California breeding population is under-estimated; b) the Channel Island/Southern California breeding population is over-estimated, c) the colony estimate and at-sea survey data are not appropriate for comparisons, particularly at the regional scale described above (i.e., the two breeding populations occur together at-sea) or d) a large population of non-breeders (i.e., floating population) exists in Northern California and is associated with the breeding colonies there and an equivalent population in the southern portion of the range does not exist or has not yet to be discovered. Analysis of at-sea data and greater survey effort at major colonies in the future hopefully will refine our knowledge of such proportions as well as population trends at these locations. To calculate the world population size, one can add estimated numbers of subadults (based on demographic predictions) to the breeding population, as well as addressing the ‘floating population’ size. This process will require many assumptions to be deliberated and quantified.

## At-sea Surveys and World Population Estimates

At-sea population surveys provide an independent method of estimating the world population size of seabirds and have been shown to be accurate as long as the entire at-sea range of a seabird is covered and the general demographic structure of the species is known (i.e., proportion of non-breeders; Clarke et al. 2003). Such surveys include both breeding and non-breeding birds. Given that ASSP are largely resident year round in the California Current, and the complete at-sea range has been fairly well covered, the species lends itself to such an analysis. Population estimates obtained at the colony typically focus on breeding birds that visit the colony and attend nests during the breeding season (Ainley 1995; Sydeman et al. 1998; McIver et al. 2009a, 2009b, 2016). Mist-netting at colonies likely captures both breeding and non-breeding birds but it is difficult to distinguish them. Non-breeding birds may attend the colony less or more frequently than adults, depending largely on the age of subadults, size of the non-breeding portion of the population, time within the breeding season and time of night. At-sea surveys are not affected by these issues. ASSP spatial distribution at-sea varies between seasons as well as from year to year and is largely driven by upwelling areas and food resources (Briggs et al. 1987; Mason et al. 2007; Ainley & Hyrenbach 2010). However, ASSP have been documented in large concentrations during the fall months may be mostly composed of molting individuals (P. Pyle, pers. comm.). For example, large flocks of ASSP have been documented in Monterey Bay ranging in size from 1000s to 7,000- 10,000 birds (Ainley 1976; Roberson 1985; Briggs et al. 1987; D. Shearwater, pers. comm.). With a distribution that has high patchiness, a rigorous and relatively high-effort sampling design would be needed to obtain the best estimates of population size. However, compared with many other seabird species with larger population sizes, greater variation in the timing of colony attendance and breeding and greater migratory behavior, variation in ASSP population sizes at-sea around the major breeding colonies at the South Farallon Islands and Channel Islands is reduced. A thoughtful analysis of available at-sea survey data is needed to independently estimate current world population size (adult and subadults). This estimate can be compared to colony estimates of breeding adults plus estimated subadults to help validate true overall population size and ensure that colony estimates are reasonable.

Some existing at-sea studies have estimated ASSP population sizes, although not all of these surveys were specifically designed for this purpose. Briggs et al. (1987) estimated 1,400 ASSP south of Point Buchon and a range of 5,600 - 11,200 north of Point Buchon for a total population of between 7,000 and 12,600 ASSP in California. Spear & Ainley (2007) estimated the ASSP population at 4,500 – 9,100 (95% confidence interval) north of Point Buchon (between 38.5° N and 36.5° N). Mason et al. (2007) indicated that densities of ASSP south of Point Buchon increased between 1975-1983 and 1999-2002. Joyce et al. (2016) have noted no change in at-sea numbers of ASSP between 1988 and 2014.

## Threats

In 2013, the U.S. Fish and Wildlife Service (2013) prepared a species report during their evaluation of whether or not to list the ASSP under the Endangered Species Act of 1973. In the USFWS species report, a list of threats was summarized from various sources. This list of threats has been replicated in this plan, supplemented with additional information and each threat is briefly commented on below (see Table 2).

**Climate Change:** Coastal warming may affect the timing and degree of prey availability (Roemmich & McGowan 1995). Low lying nest locations, particularly sea caves and low lying islets, may lose nesting habitat (e.g., McIver et al. 2016).

**Human Presence:** ASSP are prone to disturbance, including from researchers (Ainley & Boekelheide 1990). All breeding colonies are currently protected and managed. Except on nearshore rocks and islets within the California Coastal National Monument, humans are not permitted on breeding colonies without permission. Some sea cave colonies at Santa Cruz Island are visited by humans without permits but no impacts have been noted (e.g., McIver et al. 2016a, D. Mazurkiewicz, pers. comm.).

**Introduced non-native vegetation:** Introduced non-native vegetation may help increase populations of introduced house mouse at SE Farallon Island and native Deer Mouse at Santa Barbara Island (proper) by providing cover and food resources. Increases in these mouse populations have been attributed to increased predation both directly and indirectly (Harvey et al. 2013; Mills 2016; Nur et al., in review). In addition, some non-native vegetation (e.g., New Zealand spinach) forms dense mats that can cover rock crevice breeding habitat and likely render those breeding sites inaccessible to ASSP or delay ASSP from quickly entering the nest site thus making the bird more susceptible to depredation (G. McChesney, pers. comm.).

**Military Activities:** Bright lights and noise in nearshore waters could lead to disturbance of nests at San Clemente Island but nesting habitat at South Rock Seal Cove and adjacent cliffs are not directly affected by current activities. Past military activities (e.g., bombing exercises in the 1940s and 1960s) have affected nesting habitats at Prince Island but the degree of impacts has not been determined.

**Scientific Purposes:** Extensive egg collecting for museum and private collections may have impacted colonies at the Farallones and Santa Cruz Island in the late 19th and 20th centuries. Egg collecting for organochlorine pollution studies occurred in 1992-1997 and 2008 at Santa Cruz Island area and the small Orizaba Rock colony may have been impacted in 1992 when 15 eggs were collect for this study (Carter et al. 2008b; McIver et al. 2016a). Research activities can disturb ASSP (Ainley & Boekelheide 1990).

**Recreational Purposes:** Some sea cave colonies at Santa Cruz Island are visited by kayakers without National Park Service permits and Orizaba Rock also has been visited apparently by recreationalists. No impacts were noted at these sites (McIver et al. 2016a). The nearshore islets that are included in the California Coastal National Monument are currently open to the public for recreational purposes. Kayakers and perhaps other boaters may access these sites without permits. However, recreationalists accessing ASSP colonies within the California Coastal National Monument are not currently a known problem. However, Point Reyes Headland and Bird Rock are occasionally visited by recreationists traveling by boat and Chimney Rock, at Point Reyes Headland, is accessed by hikers during low tide events.

**Avian Predation:** Extensive avian predation has been recorded at SE Farallon Island (burrowing owls and western gulls) and Santa Cruz Island (common ravens and barn owls). Elevated burrowing owl predation at SE Farallon Island is related to large cyclic populations of introduced house mouse (Mills 2016; for further details see below “Reduction of Predation At Breeding Colonies” and Nur et al., in review). The western gull breeding population on the Farallones has increased and expanded dramatically since the early 1970s and they now occur abundantly in prime ASSP breeding habitat (Ainley et al. 1990; Penniman et al. 1990). Common ravens have become an issue in recent years at certain sea caves on Santa Cruz Island and Orizaba Rock (McIver et al. 2016a).

**Mammalian Predation:** ASSP typically do not breed at locations with mammalian predators. However, on occasion, extensive predation by island spotted skunks has been noted at Bat Cave and Cavern Point Cove Caves at Santa Cruz Island (Carter et al. 2008a; McIver et al. 2009b). In the Channel Islands where there are native, endemic mammals, their presence is likely the reason that any storm-petrel nesting is relegated to inaccessible terrain (e.g., steep cliffs and sea caves). House mouse occasionally prey on ASSP chicks at SE Farallon Island but this predation is not considered to have a significant impact on the ASSP population. Deer mouse may prey upon ASSP eggs or chicks at Santa Barbara Island but to date predation or scavenging at this site has only been documented on Scripps’s murrelet (*Synthliboramphus scrippsi*) and Cassin’s auklet. At Anacapa Island and San Miguel Island, introduced black rats likely have restricted ASSP to breeding in inaccessible habitats (Harvey et al. 2016). Rats were eradicated at Anacapa Island in 2002 (Howald et al. 2005) and ASSP may have responded positively (Harvey et al. 2016). They remain at San Miguel Island proper and pose a threat if they move to nearby colonies at Prince Island and Castle Rock. Coastal nearshore islets may occasionally experience predation by mammalian predators (e.g., river otters, raccoons *Procyon lotor*) as was reported in Carter et al. (2015) at Franklin Smith Rock. River otters are expanding their range and have been observed at nesting sites at Point Reyes National Seashore (Bouley et al. 2015; B. Becker, pers. comm.; S. Allen, pers. comm.).

**Disease:** No evidence of disease has been documented.

**Artificial Light:** Illumination of breeding colonies with bright lights at night can occur during squid fishing near islands and from other boats anchored near shore. Bright lights can alter activity patterns, cause disorientation and facilitate predation when ASSP return to the colony at night. Impacts from squid boats were suspected at Orizaba Rock in 1995-1997 (Carter et al. 2008; McIver et al. 2016a) and researchers suspect predation increases on nights when Southeast Farallon Island is “lit up” by boats moored off the island (P. Warzybok, pers. comm.). Large numbers of ASSP were captured on research support vessels with bright deck lights anchored beside colonies in 1994-1996 at Orizaba Rock, Scorpion Rocks and Santa Barbara Island (McIver et al. 2016; H. Carter, unpubl. data). In addition, large numbers of storm-petrels have been noted on “long range” sport fishing vessels that are brightly lit near nesting island in Baja California Norte (D. Mazurkiewicz, pers. comm.). The storm-petrels appear to become disoriented and are sometimes depredated by gulls when they fly into the side of the vessel.

**Oil Pollution:** Oiled ASSP have never been recovered on beaches or colonies. However, they likely die before reaching shore and are removed rapidly from the ocean surface and beaches by predators. A large oil spill where birds are concentrated at sea could have significant population level impacts for ASSP.

**Organochlorine Pollution:** Extensive pollution occurred in the Southern California Bight region in the 1940s to 1970. Pollutants are entrained in marine sediments and continue to be released into the environment. Impacts on ASSP, including eggshell thinning and reduced hatching success, were documented in 1992-1997 at Santa Cruz Island (Fry 1994; Kiff 1994; McIver 2002; McIver et al. 2009; Carter et al. 2008a, c). In 2008, pollutant levels were much reduced and hatching success had improved .These pollutants will likely continue to reduce reproductive success of some individuals for decades.

**Ingestion of Plastics:** Plastic ingestion has not been documented in ASSP but has been found to be common in other storm-petrel species (e.g., Spear et al. 1995). Impacts may include interference with digestion leading to starvation and introduction of toxic chemicals to birds.

**Lack of Bio-security Plan Implementation:** Along with the current eradication strategy to remove invasive non-native mammals from ASSP breeding islands, the development and implementation of bio-security plans to prevent the spread to new islands (i.e., invasion) and prevent reinvasions is needed. By doing so, the insular biodiversity will be protected and these efforts will protect the investment made in conservation efforts made previously (i.e., eradications) (Broome 2009). Island biosecurity refers to the policies and measures taken to protect insular biodiversity and ecosystems from IAS (Russell et al. 2008). Its major components are prevention, detection, and responses to incursions, which pursue the overall objective of stopping the establishment of IAS (Russell et al. 2008). An “incursion” refers to a situation where a species is believed to have arrived on an island but where a self-sustaining island-wide population has not yet established (Russell et al. 2008). An “invasion” is what follows an incursion and a species colonizes an entire island (Russell et al. 2008). For that reason, attention to incursions, including the detection of an invasive species, is highly important and represents a crucial time to eradicate an invading species. Conducting eradication efforts during the incursion phase is the more cost-effective conservation measure in comparison to conducting an eradication campaign on a species that has “invaded” an island.

# Section III. Conservation Actions

## Conservation Action Prioritization Narrative

Each action has been assigned a priority according to a determination of what is most important for the conservation of the species based on the life history, ecology, distribution, abundance, threats, and knowledge gaps. Three categories of priorities have been developed:

Priority 1: An action that can be taken to prevent decline likely to lead to extirpation of a population, colony, or distinct geographic breeding locale (e.g., islet, rock, or sea cave).

Priority 2: An action that will provide essential information needed to advance the management and/or conservation of ASSP at a population, colony, or distinct geographic breeding locale (e.g., islet, rock, or sea cave).

Priority 3: An action that can be taken to prevent any decline of an ASSP population or some other negative impact short of extirpation, extensive decline or significant mortality.

## Goals, Objectives, and Strategies

The following narrative discusses the goals, objectives, strategies and rationales that serve as the steps needed to develop and implement this conservation strategy for ASSP. A goal has been developed for each of the 4 areas of focus in this conservation action plan. The 4 areas of focus were identified by key stakeholders at the 15 October 2014 meeting at the National Fish and Wildlife Foundation office in San Francisco as follows:

* Index Monitoring Program
* Artificial habitat/nest structures
* Predation Reduction
* Surveys and Research

Goals direct objectives for improving population conditions for ASSP, with approaches for management of ASSP populations. A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units.

Objectives have been developed based on input from key stakeholders during discussions in 2015-2016 about this ASSP Conservation Action Plan, with additional information obtained from the published and unpublished scientific literature. An objective is a concise statement that indicates what is to be achieved, the desired extent of the achievement, who is responsible for the achievement, and when and where the objective should be achieved.

Strategies highlight and describe the actions needed to achieve the objectives. A strategy is a specific action, tool, technique or combination of these used to meet objectives.

Rationales for each objective provide science-based context such as background information, assumptions, and technical details.

**Goals and Objectives**

## Index Monitoring Program Goal

Create and implement a range-wide monitoring program that will provide for the detection of “biologically significant” trends in population parameters (e.g., population size, breeding success, adult survival) and place an emphasis on attributes of sampling design (e.g., randomization, bias, detection probability) and the level of precision. Monitoring should be conducted at accessible sample colonies throughout the breeding range of ASSP and incorporate data collection from small to large colony sizes as well as offshore and nearshore colonies in an effort to detect significant changes that might signal different types of conservation issues for ASSP in different habitats and geographic areas. To develop this program, a major group effort by seabird biologists, managers and others is needed to discuss various approaches. For this plan, important concepts to consider in designing and implementing this program are summarized below.

**Range-wide Objective for Index Monitoring Program:** Within 3 years of this plan, an ASSP monitoring working group will develop an ASSP monitoring plan. The plan will: 1) select appropriate monitoring locations based on colony size, ease and reliability of access and location within the ASSP range; 2) determine parameters to be monitored but should include population size/index, reproductive success and adult survival; and 3) provide standardized methods and approaches to data collection and data analysis. The resulting range-wide monitoring effort should provide long-term time-series data that will allow for analysis of “biologically significant” changes in population parameters such as population size, breeding success and adult survival to be detected in different parts of the breeding range of the ASSP. In addition, the implementation of an index monitoring program will aid in filling some of the data gaps that exist for ASSP population sizes and trends, as identified in the section on “Breeding Colony and Population Estimates”. (Priority 2)

Strategies:

* Establish formal guidelines that outline a standardized, repeatable approach to measuring ASSP population size indices (i.e., estimating breeding population size or analyzing population trends), examining reproductive success and determining adult survival.
* Build upon existing monitoring programs and augment with additional locations and parameters to allow for trend monitoring analysis and comparisons across the breeding range of ASSP.
* Maintain the South Farallon Islands as the key monitoring and research location in the northern part of the range that will conduct annual monitoring of population size, reproductive success, and adult survival. In addition, annual or periodic monitoring should be conducted at nearshore rocks in PRNS for comparison (e.g. Bird Rock, Stormy Stack).
* Maintain the Santa Cruz Island area as a key monitoring and research location in the southern part of the range that will conduct annual monitoring of population size, reproductive success and adult survival.
* Establish key monitoring location(s) in the Channel Islands region that will conduct annual monitoring of identified parameters. Candidate locations include Prince Island, and Santa Barbara Island as well as San Clemente Island (small colony size comparison).
* Establish key monitoring location(s) in Mexico that will conduct annual monitoring of identified parameters. Candidate locations include Todos Santos and Coronado islands.
* Collate and analyze past mist-net data in the Channel Islands to provide the best historical information for comparison to newly-developed baseline data.
* Identify secondary parameters (e.g., environmental variables, organochlorine pollutants) that will be used to aid the interpretation of monitored ASSP parameters.
* Obtain an at-sea estimate of the world ASSP population, either through analysis of past data or conducting a new survey, in order to provide a baseline ASSP population estimate.

Rationale:

Currently, there is no monitoring plan or formal guidelines that exist describing a standardized, repeatable approach to monitoring ASSP across its range. However, protocols have been developed to describe and standardize data collection and management activities for certain types of ASSP monitoring at some colonies (e.g., Farallones, Santa Cruz Island, Prince Island)(see Nur et al., in review; McIver & Cater 1996; McIver and Carter 1998; Adams 2015). It is important to develop a monitoring plan that standardizes the approach to tracking changes in parameters through time and implement these approaches throughout the ASSP range so that the conservation status of the ASSP can be tracked confidently. In addition, conservation efforts aimed at protecting and maintaining a viable ASSP population can be effectively evaluated with these standardized approaches. Ultimately, the long-term monitoring program should be effective at detecting significant changes in population size/trends, reproductive success or adult survival for the ASSP population.

Because the ASSP population has two core breeding areas at South Farallon Islands and the Channel Islands, the monitoring programs must include key colonies in these areas, as well as smaller colonies that represent different habitat types. In the northern portion of the species range, the monitoring of a large colony would likely occur at Southeast Farallon Islands where ASSP monitoring has occurred since 1971. In addition, small nearshore colonies at Bird Rock and Stormy Stack, monitored annually since 2012, also should be examined for comparison. Within the Channel Islands area, ASSP populations are concentrated within 3 islands and their islets: San Miguel, Santa Cruz and Santa Barbara. Santa Cruz Island should be considered as a focal location for monitoring in the Channel Islands because it is the only known location where reproductive success and population size has been measured annually through nest monitoring since 1995 and a large number of nests (i.e., ~150 nests) can be monitored annually. However, population size should be monitored regularly at Prince Island and Santa Barbara Island as well. In addition, estimates of ASSP population sizes have been made at various Channel Islands in 1975-1977 and 1991-1996 using a variety of techniques. All colonies should be resurveyed using standardized techniques to develop a better baseline for future monitoring. Since 2012, population assessment and monitoring work has been conducted at San Clemente Island where a small population breeds on an islet and likely on adjacent main island cliffs. Finally, populations in Mexico should be monitored as differing conditions and pressures likely exist for the ASSP breeding there (e.g., disturbance pressure from inhabitants/fishermen on nesting islands).

From the standpoint of ASSP conservation and management, trends in population size are the most important parameter to monitor in order to identify significant declines that may threaten species existence or result in loss of portions of the breeding range. However, evaluating causes of population change requires monitoring of reproductive success, predation and survival. Along with being long-lived, ASSP are a low-fecundity species in which adult survival is a key demographic parameter in population growth or decline (Nur & Sydeman 1999). As such, including adult survival in the ASSP monitoring program is important. Finally, monitoring the reproductive success of the ASSP also aids in detection of environmental conditions that have acute impacts (e.g., changes in prey resources or impacts from rising sea levels due to climate change, contaminants causing eggshell thinning, exposure of bright lights at a breeding colony, etc.).

The establishment of an ASSP monitoring plan that emphasizes a standardized and repeatable approach to data collection and analysis will go a long way toward the conservation of the ASSP. The collaboration of current monitoring programs across regions is essential for the success of the plan. In addition, the integration of ASSP data with data from other ongoing marine environment monitoring programs (e.g., CalCOFI cruises) will strengthen the interpretation of ASSP population trends. The ultimate goals for these monitoring efforts are: (1) to provide information that will assist and direct the long-term conservation and management of the ASSP; and (2) to better understand the biology of this very interesting storm-petrel species which is endemic to California and northwest Baja California.

## Artificial Habitat/Nest Structures Goal

Goal: As appropriate, provide and maintain artificial habitat and/or nest structures at breeding colonies to aid in the long-term survival of the ASSP (and other storm-petrel species, e.g., Leach’s storm-petrel, black storm-petrel *Oceanodroma melania*) colonies through increased nesting habitat availability, increased nesting success, or increased adult survival by reducing the risk of predation at the nest site.

### SE Farallon Island - Objectives for Artificial Habitat/Nest Structures

SE Farallon Island (A): Farallon National Wildlife Refuge (NWR) will permanently maintain and when feasible enhance rock foundation walls on the Lighthouse Hill Trail, Auklet Trail, Helo Pad, and former Eggers House with dry stone construction in order to provide a minimum of 500 horizontal meters of potential nesting habitat (with 0.5 to 1.5 m of vertical elevation and minimum of 0.5 m width) with a moderate to high density of potential nesting sites. For monitored sites, the objective would be a minimum 10-year mean of 50% occupancy rate and a 10-year mean breeding success rate of 60%, recognizing that annual ocean conditions influence occupancy and success rates. Rock walls associated with the above mention infrastructure are the most difficult and expensive to maintain and enhance but they also contain most of the artificial habitats currently used by ASSP at SE Farallon Island, potentially with hundreds of egg-laying sites that constitute a fairly large proportion of the overall population. Most other rock walls on SE Farallon Island also will be maintained and when feasible enhanced for greater potential future use by ASSP. Low numbers of LHSP have been observed nesting in the rock walls. (Priority 1)

SE Farallon Island (B): Over the next 10 years, Farallon NWR will remove certain foundations of dismantled buildings on SE Farallon Island and repurpose the materials to create additional artificial breeding habitats, as appropriate and feasible. Creation of additional artificial habitats could potentially add scores of additional nest sites once they are colonized. ASSP are not known to currently breed in these artificial habitats to any great degree but may nest there once new artificial habitat is in place, especially if assisted by vocalization broadcasting. LHSP also may use this new habitat which could increase population size. (Priority 3)

Strategies:

* Utilize rocks that have been dislodged from rock walls or other parts of the island to maintain and enhance (e.g. create additional) crevice nesting habitat along Lighthouse Hill Trail, Auklet Trail, Helo Pad, and old Eggers House.
* Utilize appropriate (e.g. contaminant-free) excess materials that may be available from demolished infrastructure (e.g., building foundations) to create additional crevice nesting habitat.
* Continue to monitor ASSP reproductive success on SE Farallon Island, maintaining a sample size of at least 70 previously occupied breeding sites.
* Every 5 years, provide for annual inspection of rock walls along the Lighthouse Hill Trail, Auklet Trail, Helo Pad and old Eggers House, particularly in areas where crevice nesting habitat for ASSP already occurs or has been created. Record damaged portions for future repair utilizing dry stone construction or similar technique that creates crevice nesting habitat.
* Annually assess any newly constructed artificial nest sites for ASSP breeding activity.
* As appropriate, utilize vocalization broadcasting and other social cues to encourage ASSP to utilize newly constructed artificial nest sites.

Rationale:

Historically, Farallon Island seabird populations were dramatically reduced by human harvesting of adults and eggs, disturbances and habitat degradation (Doughty 1971; Ainley &Lewis 1974; Ainley & Boekelheide 1990; White 1995; Carter et al. 2008, 2016). In the mid- to late- 19th century, possible degradation of ASSP and LHSP nesting habitats on SE Farallon Island came in the form of utilization of rocks collected from the island to construct walls and other temporary structures (White 1995; USFWS 2009b; Carter et al. 2008, 2016). In most cases, no mortar, cement or other material was used to hold rock walls or foundations together (i.e., dry stone construction), allowing access for crevice-nesting species such as ASSP. So it is unclear if utilization of rocks from the island (which may have provided natural crevices for ASSP) to build rock walls and other temporary structures (which provided artificial nest sites for ASSP) resulted in a net loss, net increase or stable number of available nest sites. However, later construction of mortar to hold rock walls together, especially during the World War I and II eras, may have temporarily reduced artificial nesting habitat for ASSP (Carter et al. 2016). On the other hand, construction of rock walls on the marine terrace (e.g., surrounding water catchment pads) created nesting habitat where there had been little to none (G. McChesney, pers. comm.).

The first record of ASSP breeding in natural cavities under rocks on SE Farallon Island was in 1885 (Ingersoll 1886). Between 1886 and 1911, extensive use of rock walls, rock slides and drift wood areas (i.e., on Franconia Beach; likely a.k.a. Shell Beach – see White 1995) was first noted (Dawson 1911; Loomis 1918). The ASSP population was thought to have increased during this period (Dawson 1911; Loomis 1918). Loomis (1918) speculated that the apparent increase was due to the cessation of egg harvesting at the island. This apparent increase in the ASSP population may have resulted from: (1) population recovery from a possible decline in the past due to various human activities on and off the island (e.g., habitat degradation by egg collectors, oil spill pollution) (Carter et al. 2008, 2016); or (2) greater use of “man-made” habitats (e.g., rock walls) likely making it easier to detect nesting ASSP (Dawson 1911; Ainley 1990; Carter et al. 2008, 2016). The extensive use of man-made rock walls by crevice nesting seabirds was documented although there is little information regarding the amount of man-made habitat that was available for ASSP nesting (Dawson 1911; Ainley 1990; Carter et al. 2008, 2016). However, Dawson (1911) specifically noted ASSP being “well distributed throughout the main island” using rock walls, rock slides, under driftwood on Franconia Beach (likely known as Shell Beach today) and “even burrow in the level ground in front of the keepers’ houses”. Dawson (1911) speculated that ASSP was the third most abundant seabird on the island at the time, only Cassin’s Auklets and Common Murres (*Uria aalge*) were more abundant. It is not clear what the relative population size was and many seabird populations at the Farallon Islands were greatly reduced at this time due to egging and oil pollution (Dawson 1911; Ainley 1990; Carter et al. 2008, 2016). The amount of habitat that was available to storm-petrels on the South Farallon Islands in the late 1800s and early 1900s is unknown so determining if suitable habitat has been lost or gained and whether the population has declined or increased from this time period is based on inferences made from limited information available in the literature (Carter et al. 2008, 2016). Based solely on the qualitative descriptions provided in the published reports of Dawson (1911) and Loomis (1918) it seems that the current ASSP population at the South Farallon Islands may be reduced from the early 1900s. However, such comparisons are speculative at best and difficult, if not impossible, to confirm.

The importance of the dry stone construction in providing nesting habitat for the ASSP may be underscored by the extensive use of this artificial habitat as identified in some of the earliest known publications documenting ASSP nesting at the South Farallon Islands (Dawson 1911; Loomis 1918). The dry stone construction, which forms the foundation for several sections of trail and in other structures on the island, creates crevices that are utilized by ASSP. Many of these “man-made” crevices also provide relatively easy access which allows for monitoring of ASSP reproductive success. In fact, the majority of monitored ASSP sites on SEFI occur in habitat created by dry stone construction or occur under or adjacent to other man-made structures (Russ Bradley, pers. comm.). Very few monitored sites occur in “natural habitat” (e.g., birds nesting under boulders or natural rock scree)(P. Warzybok, pers. comm.), mainly because of the difficulty in finding and following sites in natural habitat without causing substantial disturbance to pinnipeds and surface nesting seabirds. The Lighthouse Hill Trail is located within the area where a large proportion of ASSP nests occur on SE Farallon Island (Ainley et al. 1990). Maintaining this trail with a dry stone foundation, razing unused infrastructure and repurposing this material to create additional nesting habitat should aid the ASSP population, if adequate prey resources continue and high avian predation does not occur. Contributing to this objective will also support objectives identified in the USFWS Regional Seabird Conservation Plan (Objective 1c) (USFWS 2005) and the Farallon National Wildlife Refuge Comprehensive Conservation Plan (Objective 2.1).

The metrics of 50% nest site occupancy for monitored sites (as described above) is based on mean site occupancy of 54.3% (Ainley et al. 1990) and the breeding success objective of 60% is based on the long-term mean of 67% for ASSP at SE Farallon Island (USFWS 2009b). However, occupancy rates and breeding success have been lower than these levels for the past several years (R. Bradley, pers. comm.; PBCS unpubl. data).

### Santa Cruz Island and associated islands, islets and sea caves - Objectives for Artificial Habitat/Nest Structures:

Santa Cruz Island area: At appropriate ASSP nesting locations with documented predation issues, CINP and its cooperators will maintain avian predator proof artificial nest sites in order to increase the availability of protected nest sites and reduce the percentage of ASSP nest sites (adults, eggs and chicks) vulnerability to avian predation. The number of artificial nest sites deployed at selected locations will vary; with an objective of one predator proof artificial nest site provided for every five “natural” nest sites that are monitored or documented in a nesting location (based on a 5-year running average for number of nest sites). For artificial nest sites, the objective would be to observe a gradual increase in occupancy rate and breeding success over the first 5-years of artificial nest site deployment. In the fifth season after artificial nest site deployment, occupancy rate and breeding success are anticipated to be >30% and >45%, respectively, recognizing that annual ocean conditions influence occupancy and success rates and that these rates likely will vary between nesting locations. (Priority 1)

Strategies:

* CINP and it cooperators will continue to monitor ASSP population size and reproductive success in the Santa Cruz Island area (e.g., Orizaba Rock, Bat Cave, etc.). Monitoring efforts should be designed to allow for comparison with other monitoring programs throughout the range of the ASSP.
* Utilize appropriate artificial nest habitat designs that allow for protection of nesting ASSP from avian and mesopredator predation, as well as bright lights at certain colonies (e.g., Orizaba Rock; McIver et al. 2016a), and allow for effective monitoring of nest sites. In sea caves, evaluate the need and feasibility of placing artificial habitats on elevated platforms to reduce impacts from low to moderate amounts of flooding due to sea level rise and high water events from storm surges.
* As needed and appropriate, utilize social facilitation cues (e.g., sound recordings, olfactory cues, etc.) to encourage ASSP nesting in artificial nest habitat modules. Use of sound recordings may not be appropriate in these locations with elevated avian predation rates.
* As needed, utilize mesopredator traps in caves with ASSP nesting in an effort to reduce the risk of a predation event causing loss of adult breeding ASSP as well as eggs and chicks. Note: Island spotted skunks have not been documented in sea caves from 2009-2015; as such, current use of traps in sea caves is not recommended.
* Continue to educate park visitors about ASSP nesting and sensitivity to disturbance and limit access to only permitted activities in ASSP nesting habitats.
* Conduct an analysis of demographic and depredation data (e.g., population viability analysis) to aid in refining this objective and determining appropriate conservation and management actions to protect ASSP nesting in the Santa Cruz Island area.

Rationale:

Santa Cruz Island is the largest of the eight major Channel Islands and is jointly managed by the Nature Conservancy and the National Park Service. ASSP have been found nesting at 12 locations at Santa Cruz Island, including islets, sea caves and Gull Island (see Table 1). The most recent estimated breeding population size at Santa Cruz Island is 327 nests (Table 1). This number does not include estimates from suitable habitat that is inaccessible to researchers or not monitored. As such, most experts working on ASSP at Santa Cruz Island feel this number is an underestimate of the true breeding population (W. McIver, pers. comm.; D. Mazurkiewicz, pers.comm.). Regardless, the estimate of 327 nests represents 7% of the estimated world breeding population and ~18% of the estimated Channel Islands breeding population. Since 1995, the reproductive performance and trends in population size of ASSP at Santa Cruz Island have been studied at 5 locations: Orizaba Rock, Bat Cave, Cave of the Birds’ Eggs, Cavern Point Cove Caves, and Dry Sandy Beach Cave (McIver 2002; McIver et al. 2009b; McIver et al. 2016a, b). Prior to 1995, all information on the reproductive biology of ASSP was limited to work conducted at Southeast Farallon Island. The monitoring of ASSP at Santa Cruz Island has provided key knowledge about population trends and breeding performance, and impacts from various sources in the southern portion of the breeding range. Santa Cruz Island has been utilized as a monitoring site for ASSP because monitored locations are accessible under most weather conditions, nests are easily accessible (more so than all other nesting locations, except SE Farallon Island), and adequate sample sizes at each monitored location were available to assess both population trends and reproductive performance (McIver et al. 2009b, 2016).

The ASSP monitoring program at Santa Cruz Island has documented several important conservation issues over the years: (1) organochlorine contaminants have impacted reproductive success of ASSP in the southern portion of the range since the 1940s (Carter et al. 2008b; MSRP 2005; McIver et al. 2009b); (2) avian predation of adults and chicks by common ravens is relatively high and greatly impacting reproduction at certain locations (McIver et al. 2016a,b); (3) spotted skunk predation events, although infrequent, can result in the near extirpation of a breeding location from a “one time” predation event that impacts colony nesting numbers for years after the event (McIver et al. 2009a); (4) flooding of portions of low-lying nesting habitats in some sea caves (i.e., Cave of the Birds’ Eggs and Dry Sandy Beach Cave) has been observed (McIver et al. 2016a) and is likely to increase in severity due to sea level rise and storm surges due to climate change; (5) bright lights (e.g., during squid fishing) can impact certain colonies (e.g., Orizaba Rock) and cause nest abandonment or mortality leading to a decrease in colony size (Carter et al. 2008a, McIver et al. 2016a); and (6) unauthorized human activities at locations with relatively easy access (e.g., park tourists landing kayaks at Bat Cave and exploring cave habitats) could reduce reproductive success and impact nesting success (McIver 2002, McIver et al. 2009b), although major impacts from this type of activity have not been documented to date.

Several of these conservation issues could be reduced with the use of artificial nest structures. Appropriately designed artificial nest structures could reduce avian and mesopredator predation of ASSP adults, chicks and eggs at nest sites and ensure the survival of ASSP. Common ravens and barn owls are suspected to be the main avian predators while spotted skunks have been infrequent but impactful mesopredators at Santa Cruz Island. From 1995-1997, 75 adults and 6 chicks were killed mainly by barn owls at Bat Cave and Orizaba Rock (McIver 2002). In 2005 and 2008, spotted skunks killed at least 75 adult ASSP in Bat Cave and 32 adult ASSP in Cavern Point Cove Caves, respectively (McIver & Carter 2006; McIver et al. 2009b). Both colonies appeared to have taken several years to recover to pre-event breeding population sizes (McIver et al. 2013); although due to its larger relative population size (prior to 2005), Bat Cave has experienced complete recovery in terms of numbers of nesting ASSP (McIver et al. 2015). Evidence of common raven depredation of ASSP (i.e., carcasses and feather piles) was detected at Bat Cave in 2013 (n=42 predation events) and 2014 (n=22 predation events) and 2015 (n=44 predation events)(McIver et al. 2015, 2016a, unpubl. data). In addition, daytime images from reconnaissance cameras documented ravens preying on ASSP and searching through driftwood nesting habitats (McIver et al. 2015). To provide some protective habitat, 5 artificial nest modules, providing a total of 15 distinct nesting chambers) were deployed in Bat Cave in 2015; however eggs were not laid in the first year of deployment (D. Mazurkiewicz, pers. comm.). Depredation of ASSP is likely occurring while the ASSP are flying to and from the nest site (in the case of predation by barn owls) and directly at the nest site (in the case of predation by ravens)(McIver 2002; W.McIver, pers. comm.).

At Orizaba Rock, common ravens have been documented as being very adept at accessing artificial nest structures which allowed researcher access to the nest chamber for monitoring purposes (McIver et al. 2014). As such, artificial nest structures were modified in 2012-2013 to prevent ravens from gaining access to nesting ASSP but allow researchers to look into structures for monitoring purposes without direct access to the nest chamber” (McIver et al. 2016). Currently, this new ceramic design, dubbed the “bread loaf”, is a three chambered module and is the preferred artificial habitat design being utilized in the Santa Cruz Island area. This improved design should also prevent spotted skunks from gaining access to nesting petrels, eggs and chicks. It is unclear if this design will aid in decreasing barn owl depredation. However, researchers believe it may reduce the number of ASSP chicks/fledglings killed when at the nest site and pre-fledglings commence wing exercises, a behavior that researchers believe draws the attention of cave roosting barn owls to ASSP fledglings (W. McIver, pers. comm.). In 2014, 10 ceramic artificial nest structures with a total of 30 nest sites (3 nest sites per structure) were deployed at Orizaba Rock but no eggs were laid that year. In 2015, eggs were laid in 4 sites and 1 chick fledged. This suggests that, over time, these redeveloped artificial nest structures will be utilized by ASSP even without vocalization broadcasting. More rapid initial use occurred in 2008 when artificial nest sites were initially deployed with vocalization broadcasting on Orizaba Rock and occupancy rates increased from 2008 to 2011 (McIver et al. 2016a). Similarly, European storm-petrels (*Hydrobates pelagicus*) nesting in caves were shown to utilize artificial nest boxes gradually over a period of 5 years with higher nesting success than at natural sites (De León and Mínguez 2003).

In sea caves, consideration should be given to deploying predator-proof artificial sites on elevated platforms, if feasible, to reduce impacts from flooding. Flooding of portions of sea caves, resulting in deaths of a few adults and some loss of nesting habitat, has been recorded in most years since 2008 at Cave of the Birds’ Eggs (McIver et al. 2016) and in certain years at Dry Sandy Beach Cave (W. McIver, pers. comm.). Flooding appears to result when storm conditions occur during high tide events. The flooding of sea caves is expected to increase in frequency and severity with increasing sea level and increasing frequency and magnitude of extremely high coastal wave events due to climate change (NAS 2012). A possibility of mitigating for flooding impacts to sea cave colonies might be to place artificial sites on elevated platforms. This action could ensure the survival of ASSP utilizing artificial sites during major flooding events that could affect the entire floors of sea caves. However, issues conflicting with Wilderness Act designation and the placement of infrastructure in the sea caves will need to be addressed (D. Mazurkiewicz, pers. com.).

Since the purchase of the eastern part of Santa Cruz Island by the National Park Service in 1996, Santa Cruz Island has become a popular destination for tourists. Each year, thousands of tourists come to this island to recreate (D. Mazurkiewicz, pers. comm.). Common activities along the shoreline include sea kayaking, fishing and diving. The exploration of the sea caves on eastern Santa Cruz Island is a common but unauthorized activity among visitors. Peak numbers of visitors to the island coincides with the pre-egg through incubation periods of the ASSP (roughly April through July). Visitors exploring sea caves could destroy ASSP nests that are made in shallow crevices among rocks, along cave walls and in driftwood resulting in the death of adults, chicks or eggs. The National Park Service and Nature Conservancy have made efforts to reduce impacts of visitors to seabirds nesting in sea caves by conducting interpretive and education programs for kayakers, as well as placing closure signs at the entrances to monitored sea caves. However, researchers still identify visitors accessing ASSP nesting locations (D. Mazurkiewicz, pers. comm.). The use of artificial nest structures would help protect some nesting ASSP in locations where visitors are known to regularly access sea caves and ASSP nest in vulnerable sites (e.g., amongst driftwood). The use of artificial nest structures for protecting ASSP nests from unauthorized visitor impacts might be particularly useful at Bat Cave and Cavern Cove Point Caves based on limited data that documents non-researcher visitation to these locations and their close proximity to the popular Scorpion Anchorage which likely increases human activity in this part of the island (McIver et al. 2009).

### San Clemente Island and associated islands, islets and sea caves - Objectives for Artificial Habitat/Nest Structures:

### San Clemente Island area (A): At Seal Cove South Rock, the U.S. Navy, Bureau of Land Management, and their cooperators will install a minimum of 30 artificial nest sites in order to maintain an eventual minimum occupancy rate of at least 50% and a breeding success rate > 50%. (Priority 1)

San Clemente Island area (B): At Seal Cove mainland, the U.S. Navy, Bureau of Land Management, and their cooperators should conduct a trial effort to create a new colony in an accessible location at higher elevation along the edge of the bluff top that prevents flooding and is protected from avian and mammalian predators. An appropriate number of avian predator and mesopredator proof artificial nest sites should be deployed, enhanced with vocalization broadcasting, at a protected location using a predator proof fence and other techniques as necessary. An eventual occupancy rate of at least 40% and an annual breeding success rate >450% would be expected. (Priority 1)

Strategies:

* Utilize an appropriate artificial nest habitat design that allows for nest site monitoring of reproductive success and provides protection of nesting ASSP, chicks, and eggs from avian predators and flooding on Seal Cove Rock South.
* As needed and appropriate, utilize social facilitation cues (e.g., sound recordings, olfactory cues, etc.) to encourage ASSP nesting in artificial nest habitat modules.
* Monitor ASSP nests at Seal Cove South Rock. Given that only a few nest crevices exist on this rock, limited nest monitoring efforts are appropriate to detect egg laying but are not currently sufficient for documenting reproductive success. Mist-net monitoring is being used for examining trends in population size at this rock and the nearby main island cliffs. This effort is designed to allow for comparison with other mist-net monitoring programs throughout the range of the ASSP.

Rationale:

At present, San Clemente Island appears to be maintaining the existence of a small breeding population of ASSP. In 2014, Carter and Henderson (2015) estimated a breeding population size of 35-40 pairs based on mist-net captures at Seal Cove South Rock. Nests have only been found on Seal Cove South Rock where these researchers documented 3 nest crevices containing 5 storm-petrel eggs in 2014 (Carter and Henderson 2015). The presence of multiple eggs in a crevice can suggest that nesting habitat is limited; assuming that multiple pairs of ASSP attempted to breed in the same crevice. The ASSP population at San Clemente Island likely has very limited available habitat on the main island due to mammalian predators including island fox, introduced black rat (*Rattus rattus*), and feral cat (*Felis Catus*). As such, it appears nesting is limited to one offshore islet that has suitable nesting habitat and is free of predators (Seal Cove South Rock) and possibly at inaccessible cliffs located on the main island at Seal Cove.

Maintaining this small breeding population at San Clemente Island is important in order to prevent the loss of a colony within the southern end of the breeding range. In the past, larger numbers likely bred at this island. For example, China Point Island has limited crevice-nesting habitat but no evidence of breeding found there in 1991 and 1994 (Carter et al. 1992, 2009). It is currently located inside a military weapons testing area and nesting habitats appear to have been altered by military activities and use of remaining crevices has likely been prevented by human disturbances (e.g., explosions, etc.) in this area. To assist this small population, artificial nest sites should be placed on Seal Cove South Rock to increase the number of nests on this mammalian-predator free islet which likely acts as the only refuge for breeding ASSP at this island. However, since this rock is low-lying and susceptible to impacts from flooding (e.g., wave wash – see above), an effort to establish breeding on the mainland within the cliff tops in the Seal Cove area will help ensure that ASSP do not cease nesting on San Clemente Island. These measures are needed until introduced black rats and feral cats are eradicated from San Clemente Island.

Control of feral cats has been underway at San Clemente Island for many years (Bridges et al. 2015). Since 2013, the U.S. Navy and the Institute for Wildlife Studies has implemented efforts to reduce black rat in the Seal Cove area on the main island in an effort to improve conditions for crevice nesting seabirds. Until introduced predators are eradicated on the main island, they pose a great threat to nesting ASSP and limit nesting to only one possible nesting area on the main island (i.e., cliffs at Seal Cove). If cats and rats were eradicated other areas where suitable habitat exists and has little or no visitation by island fox, also may become nesting habitat, especially with the use of artificial nest sites and vocalization broadcasting.

The first step for installing artificial nest sites at Seal Cove South Rock would be to increase the number of protected nest sites. In the absence of predation, adult survival would likely be increased for this small population. Adult survival has been demonstrated to be a key demographic in the persistence of ASSP populations (Sydeman et al. 1998; Nur et al. in review). The addition of suitable nest habitat would also aid in the reduction of nest-site competition and increase breeding success by reducing egg abandonment (Carter and Henderson 2015). This conservation action would aid in the development of a larger San Clemente Island ASSP population overall and increase the probability of continued breeding until colonies can be established on the main island and introduced mammals are eradicated there. Finally, the monitoring of additional nest sites created by the artificial habitat will allow nest monitoring to be used for determining population trends, rather than mist-net captures. Occupation of newly created nest sites would likely occur within two years but may take several years more to reach an occupancy of 50% for the proposed 30 additional nest sites (see McIver et al. 2013 – response of ASSP to artificial nesting habitat).

**Coronado and Todos Santos islands – Objectives for Artificial Habitat/Nest Structure:**

Coronado Islands: Conduct a social attraction project at Coronado Norte, Coronado Medio and Islote Medio by installing at least 60 artificial nest structures and two accompanying sound systems on each island. A visitation rate of 50% and 10 breeding pairs are expected within the artificial nest structures within the next 10 years for the whole archipelago. (Priority 1)

Todos Santos Islands: Conduct a social attraction project at Todos Santos Sur and Todos Santos Norte islands by installing at least 60 artificial nest structures and two accompanying sound systems on each island. A visitation rate of 50% and 10 breeding pairs within the artificial nest structures are expected within the next 10 years. (Priority 1)

Strategies:

* Utilize appropriate artificial nests and vocalization for ASSP. Vocalizations should be recorded locally or at the closest colony possible.
* Develop and conduct a monitoring plan for ASSP, LHSP and CAAU that measures use of artificial and natural habitats, reproductive success and changes in indices for overall breeding population size at Coronado and Todos Santos Islands. The monitoring protocol should be designed to allow for some means of comparison of monitored parameters across the species range (e.g., trends in population index).

Rationale:

The Coronado Islands consist of four islands that lie 11 km (7 miles) off mainland near Tijuana, Baja California, México. Altogether these islands have an area of 2.5 km2. The islands’ topography is steep and rugged and supports several vegetation communities (Oberbauer 1999a; MSRP 2005). Vegetation types are dominated by coastal succulent scrub and coastal sage scrub. A high proportion of the islands are suitable habitat for ASSP. These islands are an Important Bird Area (Birdlife International, 2014). Coronado Islands support nine endemic terrestrial species and subspecies of animals and plants, several of which are protected by the federal Mexican Official Norm NOM-059-SEMARNAT-2010. In addition, they host one of the most diverse seabird colonies off the Baja California coast that includes ten species of breeding seabirds, six of which are listed as threatened or endangered in México and/or the United States. ASSP breeds in sympatry with two other storm-petrel species: black storm-petrel and LHSP. The differentiation of nests between ASSP and LHSP is difficult and care needs to be taken to distinguish between these two species.

In order to protect and conserve the biodiversity of the islands, GECI eradicated three introduced species from Coronado Norte and Sur: goat (*Capra hircus*) in Coronado Sur (2003), donkey (*Equus asinus*) in Coronado Sur (2003) and feral cat on Coronado Norte (1995 and 1996) and Coronado Sur (2003). These species had done extensive damaged to the flora and fauna of these islands (Nogales *et al*. 2004, Aguirre *et al*. 2011). A small population of house mouse is still present on Coronado Sur. Eradication of house mice is feasible in a short amount of time (GECI unpubl. data).

Todos Santos Islands are located 18 km off Ensenada, B.C., comprised of two islands: Todos Santos Norte (34 ha), and Todos Santos Sur (89 ha). The dominant vegetation consists mainly of maritime desert scrub and dunes (Oberbauer 1999b). The physical characteristics of the islands provide suitable breeding sites for nine seabird species, 50% listed in a category of protection by the IUCN and Mexican law. These islands are considered Important Bird and Biodiversity Area (IBA) and due to the high number and diversity of endemic species are classified as high priority marine region by the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO). Todos Santos are currently free of invasive species; important conservation efforts included the eradication of rabbit and feral cat (1999-2000), and donkey (2004) from Todos Santos Norte, and feral cat (1997-1998/1999 and 2004) and rabbit (1997) from Todos Santos Sur. ASSP breeding on both islands was suspected before but it was confirmed in 2015 through mist-net capture, in-hand identification and adult measurements, vocalization responses at nest sites and nest searches. In 2016, a total of 17 ASSP nests were found on the Todos Santos Islands (Bedolla-Guzmán, GECI unpublished data).

Artificial nest sites are needed on Coronado and Todos Santos islands to reduce interspecific competition for nesting space, to monitor breeding success and to accurately identify the species. In mixed storm-petrel species colonies (e.g., Coronado Islands) competition for nesting space with larger species (e.g., black storm-petrel) could be limiting the growth of the ASSP breeding population. Therefore, artificial burrows with an entrance size suitable for this species may increase the probability of occupancy. Moreover, artificial burrows allow total access to breeding individuals and enable an accurate identification of species. ASSP and LHSP are very similar species and identification in natural crevices is often extremely difficult. In addition, on Todos Santos, there is evidence that other storm-petrel species are visiting the islands. The utilization of social attraction may entice these other species to nest at these islands.

On both islands, ASSP nests are often inaccessible. The use of these deep crevices typically does not allow the evaluation of breeding success. Artificial nest structures would permit access to chicks with low disturbance and would allow for a detailed account of chick growth and provisioning; two variables studied on species with high buffer capacity such as storm-petrels.

## Reduction of Predation at Breeding Colonies Goal

Reduce predation by avian and mammalian predators to a low level as to eliminate predation as a significant risk to the continued survival of ASSP breeding colonies.

### South Farallon Islands - Objectives for Reduction of Predation at Breeding Colonies:

South Farallon Islands (A): Within the next 2 years, the Farallon National Wildlife Refuge, Point Blue Conservation Science and other cooperators will work to reduce impacts of burrowing owl predation to the South Farallon Islands ASSP population by capturing and relocating owls to reduce the annual burrowing owl abundance index by at least 50% to 3.1 (based on mean owl abundance index of 6.29 for 2009-2012, – see Nur et al., in review) and maintain this reduced level until invasive, introduced house mouse eradication can be accomplished and its efficacy on reducing owl predation of ASSP assessed. (Priority 1)

South Farallon Islands (B): Within the next 5 years of the completion of this plan, complete the permitting process (e.g., EIS, etc.) and begin implementing identified methods to eradicate invasive, introduced house mouse from the South Farallon Islands in order to eliminate their negative impacts to ASSP and other native species of the FNWR. (Priority 1)

South Farallon Islands (C): Within 5 years of the completion of this plan, determine the extent of western gull predation on ASSP populations at the South Farallon Islands. If warranted and feasible, implement management options to reduce predation to levels that result in the projection of a stable ASSP population based on population index values obtained from mist-net capture studies. (Priority 2)

Strategies:

* Finalize and implement the South Farallon Islands Invasive House Mouse Eradication Project.
* Until mice are eradicated, capture and relocate burrowing owls that overwinter on Southeast Farallon Island to the mainland and evaluate the effectiveness of this program in increasing adult survival of ASSP.
* Continue to monitor ASSP reproductive success and population trends on SE Farallon Island.
* Continue to conduct monitoring that will inform management decisions regarding predation of ASSP including but not limited to determining a monthly owl abundance index, monthly storm-petrel predation index and extent of western gull depredation on ASSP.

Rationale:

Since 2006/2007, the ASSP population at the South Farallon Islands has been in decline based on trend analysis of ASSP capture rates (Nur et al., in review). One major factor that has contributed to this recent decline is reduced adult survival of ASSP caused by burrowing owl predation (Nur et al., in review). To investigate the impact of owl predation on the South Farallon Islands ASSP population, Nur et al. (in review) considered three population growth scenarios when modeling plausible future populations trends based on reducing owl abundance at South Farallon Islands; Scenario A, the “observed steep decline” = 7.19 percent annual decrease in ASSP population; Scenario B, “moderate decline” = 3.36 percent annual decline in ASSP population; and Scenario C, “near stable” = 0.63 percent annual increase in ASSP population. Results of the population modeling indicate that a 50% reduction in owl abundance is expected to increase survival probability by 2.4% to 3.8% (Nur et al., in review). This corresponds to changing a population that is strongly declining to weakly declining (Scenario A), from declining to nearly stable (Scenario B) or from nearly stable to increasing (Scenario C). This level of increase in survival rates, particularly in a long-lived species such as the ASSP, will have strong positive population impacts based on modeling with various assumptions. Of course, reducing owl abundance by more than 50% would likely result in higher ASSP survival rates which would translate into greater population growth potential. In short, Nur et al. (in review) presented a compelling argument for attributing the recent decline of the ASSP population at the Farallones mainly to burrowing owl predation. The Farallones population is likely to continue to decline as long as the documented level of owl predation continues.

Nur et al. (in review), as well as others (Mills 2006, 2016; USFWS 2009b; USFWS 2013b), argue that the high owl predation levels are due to a somewhat complex hyper-predation interaction between owls, non-native house mice and ASSP. In short, migrating owls arrive to the islands in the early fall and feed primarily upon the abundant mouse population. By late fall, ASSP populations at the islands reach their lowest levels of the year. In winter, mouse populations decline substantially and owls switch to preying upon storm-petrels (both ASSP and LHSP) that are returning in greater numbers to the island, to begin site attendance and courtship/breeding activities. Owls continue to prey upon storm-petrels until they leave the island in spring, presumably to migrate back to their breeding locations. It is anticipated that the eradication of house mouse from South Farallon Islands would result in reduced numbers of fall migrant owls from remaining on the islands through the winter due to a lack of suitable food source and supply (USFWS 2009b and 2013).

The USFWS, Farallon National Wildlife Refuge staff have initiated the planning process to eradicate house mouse from the South Farallon Islands to benefit storm-petrel populations as well as other native species (e.g., endemic Farallon arboreal salamander, endemic Farallon camel cricket, etc.) residing on the Farallon National Wildlife Refuge (USFWS 2013b). However, the planning process will likely take several years before eradication efforts are initiated. As such, an immediate benefit to the South Farallon ASSP population would occur by reducing owl predation via removal of owls from the island during the late fall and winter months. A reduction of 50% in the owl abundance index will likely aid in stabilizing the ASSP population at the South Farallon Islands until house mouse eradication is conducted.

Western gull predation was shown to have a negative impact on the ASSP population in the 1970s and 1980s, especially as gulls expanded their nesting distribution into prime ASSP nesting habitats on the slopes of Lighthouse Hill (Ainley et al. 1974; Sydeman et al. 1998). A very large gull population of 8,000 – 13,000 pairs has been present at least since 1959 (Penniman et al. 1990, Warzybok et al. 2015). Nur et al. (in review) did not specifically analyze the impact of western gull predation on storm-petrel populations, however a large number of western gulls likely would need to be culled to substantially reduce gull predation levels on storm-petrels island-wide (Bradley et al. 2011). However, local reductions in predation may be possible through discouraging or preventing gull nesting in certain habitats used by ASSP and where heavy predation of ASSP has been documented. Reducing gull predation likely would have benefits for the ASSP population, especially in certain areas, but the current analysis suggests that a reduction in gull predation is not required for reducing the decline currently documented in the ASSP population; a large reduction in burrowing owl predation will suffice. However, an assessment of impacts of gull predation on ASSP should be conducted to better evaluate the benefits of potential management actions needed to reduce WEGU predation on the South Farallon Islands.

### San Miguel Island Area - Objectives for Prevention and Reduction of Predation at Breeding Colonies:

San Miguel Island Area (A): Implement biosecurity measures at Castle Rock and Prince Island in order to ensure the early detection of black rats that may disperse from San Miguel Island and eliminate any dispersed rats before they establish a substantial population. (Priority 1)

San Miguel Island (B): Within 5 years of the completion of this plan, investigate the feasibility of conducting black rat eradication on San Miguel Island. When feasible, begin rat eradication from San Miguel Island using the most appropriate and cost effective methods. (Priority 1)

Strategies:

* Until rats can be eradicated on San Miguel Island, establish protocols and processes to monitor for rat presence at Castle Rock and Prince Island and deploy eradication methods for these islets if any rats are detected.
* Implement biosecurity measures to ensure that visitors (e.g., researchers) to Castle Rock and Prince Island do not inadvertently introduce invasive species onto these islets.
* Conduct a feasibility study to determine the potential to eradicate rats from San Miguel Island, documenting rat distribution on the island, permitting and paperwork processes, and cost estimation.

Rationale:

San Miguel Island and its two major associated islets, Prince Island and Castle Rock, support important and diverse seabird colonies, including approximately one-third of the breeding seabirds in the Channel Islands (Carter et al. 1992; Wolf 2000). Approximately 14% - 15% of the entire ASSP breeding population occurs on Prince Island and Castle Rock and best estimates indicate that approximately 38% of the CINP breeding population occurs at these locations. The island is owned by the U.S. Navy (USN) but is managed by USN and CINP. Currently there is no active management for ASSP in the San Miguel Island area but limited monitoring has been conducted in recent years by U.S. Geological Survey (USGS) and CINP.

It is unclear when rats were introduced to San Miguel Island. In the late 1980s, a small rat population appeared to be restricted to the west side of the island along the shoreline, near Castle Rock (Erickson & Halvorson 1990). In 2004, a limited survey by Island Conservation documented rats distributed along shorelines and within canyons on the island. However, a more comprehensive survey would be needed to understand the full extent of rat distribution on the island. In 2007, the California Institute of Environmental Studies (CIES) and Carter Biological Consulting (CBC) documented black rat predation on Scripps’s murrelet eggs on the east side of San Miguel Island at Bay Point (Carter et al. 2008c). Currently there are no rats on Prince Island or Castle Rock. However, these islands are located 0.8 km (0.5 miles) and 1.0 km (0.62 miles) from San Miguel Island, respectively. The presence of rats throughout most of San Miguel Island represents a serious threat to the ecologically and regionally important seabird colonies on Prince Island and Castle Rock. It is possible that rats could disperse to these adjacent islets and threaten these important seabird colonies. Rapid detection of such dispersal and removal of rats before larger rat populations develop would have major potential benefits to the ASSP populations. While the risk of biologists introducing rats is very low, implementing bio-security protocols can eliminate the risk of rat introduction by biologists at these islets, also a benefit to these populations.

In 2001 and 2002, the American Trader Trustee Council successfully implemented the Anacapa Island Restoration Project, which eradicated black rats in an effort to restore seabird populations on the island. Given the similar goals and biological setting between these projects, the Anacapa Island Restoration Project should serve as a successful model for the eradication of rats from San Miguel Island. In 2005, the Montrose Settlements Restoration Program released a seabird restoration plan which included rat removal from San Miguel Island as a potential seabird restoration project (MSRP 2005). However, subsequent planning determined that eradication was not feasible due to potential impacts to the then endangered island fox population. This fox population underwent a major population crash in the 1990s due mainly to golden eagle (*Aquila chrysaetos*) predation. Although currently not considered feasible, future eradication may be possible if new methods were developed that would not impact the island fox population (i.e., development of a rat-specific toxicant) or require taking hundreds of individual foxes into captivity. In addition, effective September 12, 2016, the population of island fox on San Miguel Island (as well as on Santa Rosa and Santa Cruz islands) will be removed from the endangered species list (USFWS 2016). This likely would decrease the difficulties in developing and implementing a black rat eradication plan. The non-target risk to island foxes involved in current black rat eradication methods would need to be evaluated. A rat eradication project on San Miguel Island likely would have important benefits for breeding crevice nesting seabirds as well as other nesting birds and native plants and wildlife. For example, after the eradication of rats from Anacapa Island the number of nesting Scripps’s murrelets increased 14% per annum post-eradication, reoccupation of previously vacant study plots occurred within 1 to 3 years and hatching success nearly tripled (Whitworth et al. 2013). The first breeding record of Cassin’s auklets was documented less than one year after rat eradication (Whitworth et al. 2015). In addition, the first breeding record of ASSP was documented on Anacapa Island in 2012, approximately 10 years post rat eradication (Harvey et al. 2016). It is possible that remnant populations of Cassin’s auklets and ASSP were present on Anacapa Island before eradication of rats (McChesney et al. 1998, Carter & Whitworth 2013, Harvey et al. 2016). Increased post-eradication monitoring or seabirds nesting in areas that were previously unavailable to them due to rat infestations and more easily accessible to researchers may have led to these newly documented nesting records. Regardless of whether or not these species were nesting on the island prior to eradication of rats, the eradication of invasive mammals from islands around the world has been shown to have positive benefits to numerous seabird populations (Jones et al. 2016).

The implementation of a rat eradication project on San Miguel Island, when feasible, should result in: 1) preventing extirpation of a small number of crevice nesting Scripps’s murrelet (and possibly ASSP) breeding between Cuyler Harbor and Harris Point and at Hoffman and Bay points; 2) protection of the important seabird colonies on islets adjacent to San Miguel (e.g., Prince Island and Castle Rock); 3) decreased predation on other wildlife on San Miguel (e.g., other nesting birds); and 4) broad ecological benefits to the entire San Miguel Island ecosystem.

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### Santa Cruz Island Area - Objectives for Prevention and Reduction of Predation at Breeding Colonies:

Santa Cruz Island Area – (A): At appropriate ASSP nesting locations with documented depredation issues, CINP and its cooperators will maintain avian predator proof artificial nest sites in order to increase the availability of protected nest sites and reduce the percentage of ASSP nest sites (adults, eggs and chicks) vulnerability to avian predation. The number of artificial nest sites deployed at selected locations will vary; with a general prescription of one predator proof artificial nest site provided for every five “natural” nest sites that are monitored or documented in a nesting location (based on a 5-year running average for number of nest sites). For artificial nest sites, a gradual increase in occupancy rate and breeding success over the first 5-years of artificial nest site deployment is anticipated. In the fifth season after artificial nest site deployment, occupancy rate and breeding success are expected to be >30% and >45%, respectively, recognizing that annual ocean conditions influence occupancy and success rates and that these rates likely will vary between nesting locations. (Priority 1)

Santa Cruz Island Area – (B): CINP and its cooperators will begin attempting various management strategies to reduce avian predation at ASSP breeding locations with documented avian predation issues within the Santa Cruz Island area. Within 5 years of plan approval, avian predation rates, as measured by counts of distinct feather piles, will be substantially reduced from current rates. (Priority 1)

Strategies:

* Continue to conduct nest monitoring that will inform management decisions regarding predation of ASSP including carcass/feather pile counts during nest check visits.
* Assess the status of common ravens, barn owls and island spotted skunks at Santa Cruz Island and examine impacts of predation on ASSP adult survival and breeding success. Specifically investigate common raven dynamics and determine if avian or other predation is a factor limiting population size.
* Evaluate additional measures that might be taken to reduce common raven predation on ASSP (e.g., reduction of food sources near ASSP nesting sites, targeted removal of individual common ravens, use of various innovative predator exclusion techniques).
* Utilize appropriate artificial nest habitat designs that allow for protection of nesting ASSP from avian and mesopredator predation, as well as bright lights at certain colonies (e.g., Orizaba Rock; McIver et al. 2016a), and allow for effective monitoring of nest sites. In sea caves, evaluate the need and feasibility of placing artificial habitats on elevated platforms to reduce impacts from low to moderate amounts of flooding due to sea level rise and high water events from storm surges.
* As needed and appropriate, utilize social facilitation cues (e.g., sound recordings, olfactory cues, etc.) to encourage ASSP nesting in artificial nest habitat modules. Use of sound recordings may not be appropriate in these locations as long as elevated avian predation rates continue.
* As needed, utilize mesopredator traps in caves with ASSP nesting in an effort to reduce the risk of a predation event causing loss of adult breeding ASSP as well as eggs and chicks. Note: Island spotted skunks have not been documented in sea caves from 2009-2015; as such, currently use of traps in sea caves is not recommended.
* Continue to educate park visitors about ASSP nesting and sensitivity to disturbance and limit access to only permitted activities in ASSP nesting habitats.
* Conduct an analysis of demographic and depredation data (e.g., population viability analysis) to aid in refining this objective and determining appropriate conservation and management actions to protect ASSP nesting in the Santa Cruz Island area.

Rationale:

The ASSP monitoring work that has been conducted at Santa Cruz Island since 1995 has documented the importance of this breeding location to the overall ASSP population (as noted above) as well as raising several concerns regarding predation on ASSP at Santa Cruz Island including: (1) avian predation of adults and chicks by barn owls and common ravens that may play a significant role in reducing the viability of certain colonies and the overall Santa Cruz Island population and (2) spotted skunk predation events, although infrequent, can result in the near extirpation of a breeding location from a one-time predation event (McIver 2002; McIver et al. 2009). Management actions (e.g., limited trapping and avian proof artificial nest sites deployed) have been initiated to help reduce the impacts of predation on the Santa Cruz Island ASSP population. These actions will likely play a key role in maintaining higher population sizes at certain colonies and for the overall Santa Cruz Island population which comprises an important portion of the world breeding population and helps sustain the southern half of the breeding range.

Avian predation and impacts from mesopredators could be reduced or eliminated with the use of artificial nest structures and the deployment of lethal “body-grip” snap traps in ASSP caves (designed to target mesopredators). Appropriately designed artificial nest structures could reduce avian and mesopredator predation of ASSP adults, chicks and eggs at nest sites that are exposed or easily accessible, such as those that occurred in sea caves and on Orizaba Rock. Common ravens and barn owls are suspected to be the main avian predators while spotted skunks have been infrequent predators but with major impacts at Santa Cruz Island. From 1995-1997, 75 adults and 6 chicks were killed by barn owls at Bat Cave and Orizaba Rock although barn owls have not been identified as causing heavy predation in recent years (McIver 2002, W. McIver pers. comm.). In 2005 and 2008, spotted skunks killed at least 75 adult ASSP in Bat Cave and 32 adult ASSP in Cavern Point Cove Caves, respectively (McIver & Carter 2006; McIver et al. 2009). Bat Cave began to recover soon after the skunk predation event but Cavern Point Cove Caves has had a much delayed response but started to increase several years later; neither had recovered to pre-event population sizes by 2013 (McIver et al. 2015). Heavy predation by common ravens began to be observed in 2012 at Orizaba Rock and in 2013 at Bat Cave. In 2013, 45 distinct ASSP feather piles identified in Bat Cave were attributed to common raven predation (McIver et al. 2015). In 2014 and 2015, heavy predation by common ravens also occurred at Bat Cave and Orizaba Rock (D. Mazurkiewicz, pers. comm.).

Common ravens have been documented as being very adept at accessing initial artificial nest structures in 2008-2012 designed to allow researchers to access the nesting chamber of the artificial nest structure for monitoring purposes (McIver et al. 2016). While most sites accessed by ravens did not contain ASSP adults or chicks, a few did. To prevent raven impacts, artificial nest structures have been redeveloped in 2013. The new design prevents ravens from gaining access to nesting ASSP and limits researchers to only looking into structures for monitoring purposes (i.e., there is no direct access to the “nest chamber” for handling eggs or chicks). This design likely will also prevent spotted skunks from gaining access to nesting petrels, eggs and chicks although this has not been tested. In 2014, 10 ceramic artificial nest structures with a total of 30 nest sites (3 nest sites per structure) were deployed at Orizaba Rock without vocalization broadcasting. Active nests sites increased from two in 2014 to four in 2015 with two fledged ASSP. This suggests that, over time, these artificial nest structures will be utilized by ASSP without the use of vocalization broadcasting.

The current rate of common raven predation, as measured by ASSP feather piles collected during monitoring visits to the nesting sites, is alarming. To date, there has not been an analysis to determine the impacts of the documented predation on the Santa Cruz ASSP population. At a minimum, monthly monitoring should continue at all five locations to quantify predation until modeling can be conducted to examine its long-term impacts on breeding success and population size (see section on survey and research below). Additional efforts, beyond artificial nest structure implementation, should be considered for controlling common ravens, particularly at Bat Cave and Orizaba Rock, to prevent continued high impacts in the near future which will likely result in population decline.

**Coronado Islands – Objectives for Prevention and Reduction of Predation at Breeding Colonies**:

Coronado Islands Area (A): In the next 3 years, design and implement a biosecurity strategy for these islands in order to ensure protection against invasive species. (Priority 1)

Coronado Islands Area (B): In the next 5 years, assess the status of common raven, barn owls, and peregrine falcon (*Falco peregrinus*) at Coronado Islands and examine impacts of predation on ASSP adult survival and breeding success. Determine if avian predation is a factor limiting population size. (Priority 2)

**Todos Santos - Objectives for Prevention and Reduction of Predation at Breeding Colonies**:

Todos Santos Islands Area (A): Create a buffer zone of a minimum of 30 m adjacent to each natural and artificial ASSP nest, as determined during the 2015 breeding season in which WEGU nests are removed annually in order to decrease depredation of ASSP. (Priority 1)

Todos Santos Islands Area (B): Reduce the total breeding pairs of WEGU to 8,800 breeding pairs within the next 5 years and keep the WEGU population at this level over the next 10 years. It is important to note that this population estimate was determined in an anomalous climate year and the number could increase in “normal” years. (Priority 1)

Todos Santos Islands Area (C): In the next 3 years, design and implement a biosecurity strategy for these islands in order to ensure protection against invasive species. (Priority 1)

Todos Santos Islands Area (D): In the next 5 years, assess the status of common raven, barn owl, burrowing owl and peregrine falcon at Todos Santos Islands and examine impacts of predation on ASSP adult survival and breeding success. Determine if avian predation is a factor limiting population size. (Priority 2)

Strategies:

* Continue to monitor WEGU nesting and documenting population trends on Todos Santos Islands (Sur and Norte).
* Continue to conduct ASSP nest monitoring that will provide information for management decisions regarding predation of ASSP including carcass/feather pile counts during nest check visits.
* Create a buffer zone within 30m of each ASSP nest by preventing or destroying WEGU nests in this “WEGU nest-free” zone.
* Install avian predator proof artificial nest sites in order to provide protective cover for ASSP nesting in habitats that are accessible by avian predators.
* Assess the status of common ravens and barn owls at Todos Santos Island and examine impacts of predation on ASSP adult survival and breeding success. Determine if avian predation is a factor limiting population size.
* Evaluate additional measures that might be taken to reduce WEGU predation on ASSP (e.g., reduction of food sources near ASSP nesting sites, targeted removal of individual WEGU).
* Evaluate Coronado and Todos Santos Island visitation characteristics and design a biosecurity plan in collaboration with local users.

Rationale:

In 2015, GECI calculated between 5,846 and 9,598 WEGU nests on Todos Santos Sur Island and 2,248 and 3,691 WEGU nests on Todos Santos Norte (95% confidence interval and 26% error for both locations) (Bedolla-Guzmán, GECI, unpublished data). Since 2013 GECI has been conducted active conservation actions using social attraction techniques regarding ASSP amongst others, and monitoring the avifauna on the region (Bedolla-Guzmán, GECI, unpublished data). A 10% reduction in the number of ASSP carcasses found during nest searches is anticipated by maintaining a buffer zone around ASSP nests that is void of WEGU nesting.

## Survey and Research Goal

Develop and conduct research activities to fill information gaps on known and potential threats as well as enhance the overall understanding of conservation actions necessary for the continued existence of ASSP. Give special emphasis to conducting surveys at previously unsurveyed coastal rocks within the range of the ASSP to assess and identify breeding locations, relative breeding population size, suitable nesting habitat or evidence of ASSP presence, and conduct surveys of important colonies without current information on population size. Develop and conduct research activities to fill information gaps on known and potential threats as well as to enhance the overall understanding of conservation actions necessary for the continued existence of ASSP.

### Colony Survey and Colony Size Estimate Objectives

Southern Humboldt, Mendocino, Sonoma and Marin Counties: Conduct surveys for nesting ASSP at all accessible coastal rocks with suspected suitable nesting habitat from southern Humboldt County to Dillon Beach, northern Marin County (excluding central Mendocino County between Kibesillah Rock and Franklin Smith Rock where ASSP nesting was documented in 2012) within 5 years of plan approval. Highest priorities are: (a) Steamboat Rock, Sugarloaf Island and False Cape Rocks to determine status of ASSP at these possible breeding locations (note: ASSP eggs were collected from Steamboat Rock in 1914 suggesting that this site and other rocks nearby are likely to have ASSP breeding at them – see Carter et al. 2015); and (b) Fish Rocks and Gull Island where LHSP nesting has been documented. (Priority 2)

San Francisco and San Mateo Counties: Conduct surveys for nesting ASSP at portions of the South Farallon Islands (i.e., West End Island and Islets), the North Farallon Islands, and nearshore rocks along the mainland within 10 years of plan approval. Highest priorities are: (a) West End Island and Islets because they may host an important portion of the population at the South Farallon Islands; and (b) Alcatraz Island, San Pedro Rock and Año Nuevo Island to evaluate past ASSP presence at these locations (note: ASSP specifically have not been confirmed at San Pedro rock but odor of storm-petrels has been detected in crevices but no storm-petrels have been observed; M. Parker, pers. observations). At the North Farallon Islands, three of the four major islets were surveyed for ASSP in September 1994. No ASSP were found and available habitat was considered to be limited (McChesney et al. 1994). (Priority 2)

Monterey, San Luis Obispo and northern Santa Barbara Counties: Conduct surveys for nesting ASSP at all accessible coastal rocks with suspected suitable nesting habitat from Bird Rock, Monterey County to Point Conception, Santa Barbara County within 10 years of plan approval. Highest priorities are: Cape San Martin and Point Piedras Blancas, the largest nearshore rocks in this region that has potential to host a relatively large population as well as rocks in the Diablo Canyon/Point Buchon area; (b) cliffs and offshore rocks near Vandenberg Air Force Base to evaluate possible nesting near locations where ASSP have been captured in mist-nets and (c) cliffs at Point Arguello. (Priority 2)

Channel Islands within Santa Barbara, Ventura and Los Angeles counties: Conduct surveys for nesting ASSP on San Miguel Island, Santa Rosa Island, Santa Cruz Island and Santa Barbara Island, Sutil Island and Anacapa Island (exclude San Clemente and Santa Catalina islands which have been recently surveyed) within 10 years of plan approval. Highest priorities are: (a) Prince Island, Santa Barbara Island and Sutil Island to update mist-net based population size estimates for ASSP, LHSP and BLSP; (b) Castle Rock to determine status of ASSP nesting and estimate breeding population size; and (c) cliffs on the north sides of San Miguel and Santa Cruz islands for evaluation of potential breeding because these areas are suspected of hosting undetected populations. (Priority 2)

Baja California Norte: Conduct surveys for nesting ASSP at Coronado, Todos Santos, San Martín, San Jeronimo, and San Benito islands within 10 years of plan approval. Highest priority is: (a) Coronado Islands to update species ratios and develop population estimates for ASSP, LHSP and BLSP. (Priority 2)

Strategies:

* For previously unsurveyed habitats identified above, conduct searches for potential nesting habitat and nests (using small hand-held flashlights and burrow scopes as needed) and call playback (using vocalization recordings played at potential nest site entrances to elicit a vocal response) at accessible cliffs and rocks. Conduct surveys in the incubation period (June-July) to allow identification of incubating adults or in late summer-early fall (August-September) if necessary to avoid disturbance to surface nesting seabirds.
* To detect continued presence at known colonies, determine presence at unknown but suspected colonies and document presence/absence at hard to monitor locations, use automatic acoustic sensors (e.g., song meters) to detect vocalizations over the breeding season. This method could be important at colonies with surface nesting birds as recorders could be placed prior to the nesting season and retrieved after the breeding season.
* To estimate an index of population abundance at relatively large colonies, particularly those with large amounts of relatively inaccessible breeding habitat, use mist-netting with vocalization luring and banding on several nights within a breeding season to gather data related to species of storm-petrel present, adult survival, movements between colonies, conduct capture-recapture analyses and determine captured per unit effort.
* Estimate population sizes for relatively small colonies using numbers of nests found, estimated number of nest sites and estimated site occupancy. Insure that work clearly defines occupancy and suitable habitat assumptions and quantifies how any estimated parameters were produced.
* Continue to support on-going colony survey activities throughout the ASSP range.

Rationale:

Three major problems affect our knowledge of ASSP distribution and relative breeding population sizes: (1) surveying ASSP breeding colonies is very difficult given their rock crevice habitat and nocturnal colony behavior; (2) past surveys for ASSP breeding colonies in California and Baja California were incomplete, and many rocks were not searched either to avoid disturbance to surface-nesting seabirds, difficulty of access to nesting habitat or time limitations; and (3) current population size at several important colonies is poorly known, especially at Santa Barbara/Sutil islands (2rd largest colony) and Prince Island (part of the 3rd largest colony with Castle Rock and San Miguel Island; but 2nd largest single breeding locale) where sizes were determined with mist-netting in 1991 and recent information has been obtained but not analyzed to determine population estimates. In 2012, Carter et al. (2015) confirmed breeding by ASSP along the central coast of Mendocino County, California in a region where ASSP nesting had not been detected since 1926 despite major seabird surveys conducted in 1979-1980 (Sowls et al. 1980) and 1989 (Carter et al. 1992). Even more recently Carter et al. (2016a) also discovered that northernmost ASSP breeding was documented in 1914 at Steamboat Rock off Cape Mendocino. In this area, no surveys of rocks for breeding storm-petrels were conducted in 1979-1980 or 1989, yet large rocks exist with potential nesting habitats that may host a major population of ASSP or LHSP at Steamboat Rock, Sugarloaf Island and False Cape Rocks (Carter et al. 2015a, 2016a). In 1996 and 1997, McChesney et al. (2000) reported ASSP nesting in coastal rocks within Monterey County in areas that had not been searched before. It has become clear that much suitable nesting habitat in northern and central California has not been surveyed and may contain significant numbers of breeding birds or represent small poorly documented populations. To ensure that conservation actions are applied appropriately throughout the range of the species, knowledge of all larger colonies is imperative (e.g., Prince Island, Santa Barbara/Sutil islands, Santa Cruz Island). To ensure that ASSP are sufficiently protected throughout their range, knowledge of small colonies is needed. The additional knowledge of whether or not ASSP nest in these areas will be important to developing appropriate management, monitoring and conservation actions for agencies and organizations responsible for management of ASSP population in these areas.

Population estimates for ASSP at Prince Island and the Santa Barbara Island area were based on capture-recapture analyses in 1991 (Carter et al. 1992) and have not been re-estimated since then. Prince and Santa Barbara areas hold about 10% of the known ASSP breeding population; assuming the 1-year estimates from 1991 are still representative of the population size currently (Table 1). These colonies need to be resurveyed to verify 1991 population estimates and to determine if major changes have occurred. Populations have fluctuated at some nearby Santa Cruz Island colonies between 1995 and 2015 due mainly to reduction of organochlorine pollution impacts and major mammalian and avian predation events (McIver et al. 2016). Population estimates at Bird Rock (Marin County) in 1989 also had been based on capture-recapture analyses but extensive nest searches in almost all habitats in 2012-2015 did not find sufficient nests to support those estimates (Becker et al. 2016). In addition, Castle Rock off San Miguel Island also has never been adequately assessed for estimating population size, mainly due to issues with access, disturbance to surface nesting seabirds and presence of marine mammals year round. Surveys in late summer or early fall on the east rock only (i.e., fewer marine mammals) are needed to assess population size. At Santa Barbara Island area, preliminary comparisons by Harvey et al. (2013) to earlier ASSP work (Wolf et al. 2000) suggests that this colony may have experienced a negative trend between 1991 and 2011. However, insufficient data was collected in both years for a valid comparison and much larger data sets gathered in 1991 (Carter et al. 1992) and 2005-2007 (Adams 2016) were not considered in this analysis. A new extensive updated survey is needed to both set a solid baseline for future comparisons and to compare with all past data sets to best assess current status.

ASSP populations at Todos Santos Islands were recently assessed using a variety of techniques including nest searches, mist-netting and recording calls. In 2015, a population size of 17 breeding pairs was estimated using these techniques (Table 1) (Bedolla-Guzmán, GECI, unpubl. data). However, populations at the Coronado Islands still need to be adequately assessed. Carter et al. (2006a) reported greater numbers of ASSP at Middle Rock than the few pairs reported for all 4 islands by Everett and Anderson (1991). However, LHSP and BLSP are known to breed at these islands in relatively large numbers, it was difficult to identify species of storm-petrel inside nest crevices, methods were not fully standardized between observers, and subsequent methods of separating ASSP from LHSP were considered suspect (Carter et al. 2016a,b). Extensive mist-netting may be the best approach available to assessing population size at the Coronado Islands and some past mist-net data exists for 1989-1991 for comparison (W.T. Everett, unpubl. data).

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### At-sea Survey Objectives

At-sea Survey – (A): Every decade or until ASSP specific survey methodology are developed and implemented, collate ASSP data from existing at-sea surveys using standardized protocols to determine at-sea distribution and world population size and collate information from non-standardized “bird-watching” trips. Compare estimated population size between periods for a general measurement of overall change in population size and to identify any changes in foraging hotspots. (Priority 2)

At-sea Survey – (B): Develop and implement at-sea survey methodologies specific for ASSP, likely utilizing adaptive sampling with a stratified random approach, to determine at-sea distribution and estimate world population size every 3 to 5 years. This objective likely would involve use of an aircraft to cover large areas in a short period of time. (Priority 2)

Strategies:

* Collate data from aerial surveys (e.g., Briggs et al. 1987, Mason et al. 2007)
* Collate data from shipboard surveys (e.g., Briggs et al. 1985; Spear et al. 2004; Spear and Ainley 2007)
* Until at-sea census specific for ASSP is developed and implemented, collate and analyze data from existing at-sea seabird surveys every decade and determine major changes in estimated population size and at-sea distribution
* Conduct a study to develop an at-sea survey protocol specific for ASSP that can effectively monitor trends in at-sea distribution and world population size (see study objectives below). Implement the developed protocol every 3-5 years or as needed based on colony-based information (e.g., decline in breeding population trends) in order to assess trends in the total ASSP population.
* Collate data from at-sea bird watching trips to assist in understanding at-sea distribution and world population size of ASSP.

Rationale:

An important part of conservation of the ASSP is to monitor population size and at-sea distribution in order to identify significant changes in populations over time and to identify marine conservation issues that may affect ASSP. Some experts have shown that for nocturnal cavity nesting seabirds, at-sea estimates can provide an independent estimate of the world population size over a period of time for validation of the traditional approach of determining world population size based on the sum total of colony-based estimates. Also, differences in at-sea estimates between periods of time can be compared with colony-based measures of trends to determine if trends at those colonies represent the entire population. Given the restricted range of the ASSP and their behavior of aggregating (especially during fall months), at-sea surveys for ASSP may be relatively accurate compared with more wide ranging seabird species. Collating and summarizing information on the at-sea distribution of ASSP also is critical for assessing potential at-sea impacts (e.g., oil pollution, military activities at sea, commercial fisheries, etc.) and changes in prey resources and the marine environment expected with climate change throughout the range of ASSP.

Furthermore, a well designed at-sea survey specific for ASSP, would likely allow for the best estimate of the world ASSP population. Given the restricted range of the ASSP and the ability to survey ASSP via aircraft, conducting periodic, broad-scale, nearly instantaneous at-sea surveys to estimate total population size of ASSP may be the best method to analyze world population trends and evaluate the cumulative success of conservation efforts at the world population level.

### Research Objectives

#### Santa Barbara Island Area: Determine the current extent of predation on ASSP nesting on Santa Barbara and Sutil islands and investigate need for management actions (e.g., barn owl roost site alterations, mouse control, owl removals) to benefit the ASSP populations in the Santa Barbara Island area. (Priority 2)

Strategies:

* Continue efforts similar to Thomsen et al. (2014) to include ASSP in the study.
* Conduct ASSP population estimates/monitoring on Santa Barbara Island and Sutil Island.
* Investigate roost site alterations as a means to reduce barn owl predation on ASSP.
* Monitor native deer mouse, western gull and peregrine falcon population sizes/trends and their impacts on ASSP populations.
* Consider developing marked populations on Santa Barbara and Sutil islands to assess degree of visitation by individuals between these two nesting areas. This will aid in making management decisions between the two breeding sites.

Rationale:

Currently the breeding population size of ASSP in the Santa Barbara Island area (including the main island, Sutil Island and Shag Rock) is estimated at 731 breeding pairs and comprises the second largest ASSP breeding area. However, this population estimate is dated and is based on mist-net captures conducted at the main island and Sutil in 1991 (Carter et al. 1992) and 1 nest found on Shag Rock in 1996 during an incomplete nest survey (H. Carter, pers. comm.). It is unclear what current ASSP population size and trends are in the Santa Barbara Island area. Several studies have implicated barn owls as potentially having an impact on the ASSP population in this area, although no direct evidence has been obtained (Wolf et al. 2000; Whitworth et al. 2011; Harvey et al. 2013). In addition to barn owl predation, ASSP adults have been documented being preyed upon by western gulls and ASSP eggs and chicks have been taken by native deer mice (Wolf et al. 2000, Whitworth et al. 2011). Conducting population size/trend studies in conjunction with a predation study is warranted given the significant impacts that predation, particularly owl predation, has been shown to have on ASSP populations at South Farallon Islands (Nur et al., in review).

#### Santa Cruz Island Area: Determine the current extent of avian predation on ASSP nesting in the Santa Cruz Island area (particularly at Bat Cave and Orizaba Rock) and investigate need for management actions (e.g., barn owl roost site alterations, common raven mitigation) to benefit the ASSP populations in the Santa Cruz Island area (Priority 2).

Strategies:

* Conduct ASSP population trend analysis and reproductive monitoring in the Santa Cruz Island area
* Investigate roost site alterations as a means to reduce barn owl predation on ASSP
* Conduct an evaluation of raven distribution and abundance at Santa Cruz Island, similar to Boarman and Coe (2002)
* Conduct an evaluation of raven responses to human presence at Santa Cruz Island, similar to Marzluff and Neatherlin (2006)
* Conduct and evaluation of barn owl predation on ASSP, similar to Thomsen and Plumb (2014)

Rationale:

Heavy predation by common ravens began to be observed in 2012 at Orizaba Rock and in 2013 at Bat Cave. In 2013, a “majority” of the 45 distinct ASSP feather piles identified in Bat Cave were attributed to common raven predation although some may have been caused by barn owls (McIver et al. 2015). In 2014 and 2015, heavy predation by common ravens appears to have continued at Bat Cave and Orizaba Rock (D. Mazurkiewicz, pers. comm.). The Santa Cruz Island area holds the 4th largest nesting population of ASSP with an estimated 327 breeding pairs.

Blake (1887) described common ravens as common breeders at Santa Cruz Island. The main food source available for ravens from the mid-19th century to the late 20th century was dead livestock which ravens scavenged (Blake 1887, Schuyler 1993). Management of most of the island moved from a private ranch to The Nature Conservancy in the 1970s, although management of the east end did not move from a smaller private ranch to the NPS until the late 1990s (Schuyler 1993; Faulkner and Kessler 2011). Once included in the CINP, the east end and Scorpion Ranch were opened for public use and now receives thousands of visitors to the island for day use and camping each year. It is the busiest location in the CINP and receives the majority of Park visitors annually (D. Mazurkiewicz, pers. comm.). The primary campground is located at Scorpion Ranch and Scorpion Anchorage which is about 1 km from Bat Cave. Marzluff and Neatherlin (2006) hypothesize that food is the most important anthropogenic resource driving the increase of corvids near campgrounds. Ravens are known to be adept at obtaining food from campgrounds, including using techniques such as opening gate latches, backpack zippers and food containers (Janiskee 2010) and individuals can become specialized in their feeding behaviors (Marzluff and Angell 2005). Ravens visiting Orizaba Rock appeared to have learned how to access one type of artificial nest site in order to access the nest contents (McIver et al. 2016; W. McIver, pers. comm.). In recent years, ravens appear to have learned that ASSP nesting at Orizaba Rock and Bat Cave in shallow natural crevices and under driftwood are easily accessible to them (W. McIver, pers. comm.).

The current rate of predation, as measured by ASSP feather piles collected during monitoring visits to the nesting sites, is concerning. To date, there has not been an analysis to determine the impacts of the documented predation on the Santa Cruz ASSP population. However, studies at the South Farallon Islands have indicated that heavy and increased predation on adult storm-petrels resulted in a decrease in annual storm-petrel survival and a significant population decline of nearly 6% per annum over a 5-year period (Nur et al., in review). It is necessary to assess the impacts of avian predation on the Santa Cruz Island ASSP population in order to determine: (1) if management actions are warranted to protect this nesting population and (2) if action is warranted, utilize the best information available to implement the most appropriate and effective management actions in order to protect the ASSP breeding at this important location.

#### Throughout the ASSP Range: Investigate the impacts to ASSP from artificial nocturnal lighting that is emitted from oil platforms and recreational and commercial vessels working near breeding colonies. (Priority 2)

Strategies:

* Design and implement a study of ASSP breeding colonies located near anchorages or squid boat operations with brightly lit lights (See Gillespie et al 2016).
* Investigate ASSP response to light emitted from oil platforms and potential impacts on increased predation by peregrine falcons due to increased at-sea perches/roosts and the ability to hunt at night due to infrastructure lighting (See Hamer et al. 2014).
* Determine light levels that are currently emanating from squid boats with shields.
* Examine effects of recreational and commercial boat lights anchored or operating near colonies on ASSP and nocturnal predator behavior under differing environmental conditions.
* Conduct study of ASSP response to differing light intensities and wavelengths to obtain a better understanding of attractions and potential ways to reduce attraction.

Rationale:

Evidence from several studies on seabird attractions to lights and anecdotal observations specific to ASSP indicate that ASSP are likely attracted to lights (Carter et al. 2000, Carter et al. pers. comm., D. Pereksta, pers. comm.). In addition, bright lights used by squid fishing boats operating near Orizaba Rock may have contributed to reduced reproductive success (McIver et al. 2016). Furthermore, peregrine falcons have been observed preying on Scripps’s murrelets at night utilizing the lights from offshore oil platforms to allow for this type of hunting. However, very little is known about the impacts of this light attraction and possible increased predation risk by falcons utilizing offshore oil platforms. It is necessary to assess the impacts of bright lights on ASSP in order to determine: (1) if management actions are warranted to protect nesting populations where bright light impacts may be occurring and (2) if management actions are warranted on offshore oil platforms to aid in the reduction of light impacts from possible collisions and possible increased predation by peregrine falcons.

#### Throughout the ASSP Range: Investigate the impacts of offshore wind energy development projects proposed off the California coast on ASSP to inform effects analysis and decision making. (Priority 2)

Strategies:

* Ensure that the appropriate permitting and resource agencies are considering effects to ASSP from proposed offshore wind energy developments off the California coast.
* Revise and analyze at-sea seabird distribution surveys (See Mason et al. 2007).
* Assess the vulnerability of the ASSP range-wide population to wind energy infrastructure in the California Current System. Include information such as identifying the area over which biological impacts may occur, displacement issues, collision mortality potential, and connectivity between key populations.
* If development is permitted, investigate and develop methodology to monitor collision mortality at-sea.
* Collect baseline information and if development is permitted, monitor in order to determine responses to construction and operation of wind energy infrastructure.

Rationale:

In March 2016, BOEM announced it would be taking the first steps toward potential leasing for commercial offshore wind energy development in California. These steps are being taken in response to a January 2016 lease request by Trident Winds, LLC. The lease request proposed a project that would be located approximately 30 miles northwest of Morro Bay in waters ranging in depth from 2,600 to 3,300 feet and in an area covering 68,000 acres. The project would utilize approximately 100 floating foundations anchored to the seafloor, each supporting an 8 megawatt turbine. The proposal indicates that the project could be expanded to generate up to 1,000 megawatts in the future. In summer 2016, BOEM anticipates publishing a Federal Register notice to determine if there is competitive interest in the lease area requested by Trident Winds. In addition, BOEM will be soliciting input on site conditions, uses in the project area (e.g. commercial, military, etc.) and potential impacts of the proposed project. Regardless of competitive interest, BOEM anticipates moving forward with the leasing processes in some manner (i.e., competitive or non-competitive leasing process). In addition, BOEM will use responses to the Federal Register notice to inform decision-making about the proposed project and to identify potential issues for NEPA analysis.

Impacts to ASSP are likely during the construction and operational phases of the project. Bailey et al. (2014) assessed the environmental impacts of offshore wind farms and identified a number of concerns for seabirds including: 1) spatial distribution and flight heights are needed for the development of collision risk models in order to determine likelihood of co-occurrence with wind turbine blades and their avoidance response to estimate mortality risk; 2) focus should not only be on mortality but also on the energetic consequences of avoidance and displacement behaviors and their impacts on survival and reproductive success; 3) vulnerability and mortality at offshore wind turbines will likely be related to a combination of site-specific, species-specific and seasonal factors as documented in onshore wind turbines. ASSP appear to utilize the area in the vicinity of the proposed Trident Winds project (Mason et al. 2007; Adams & Takekawa 2008). In addition, the project area is located in the middle of the 2 breeding population centers and may impact movement between these areas. It will be important to ensure that impacts of offshore wind energy projects on ASSP are properly considered and if projects are permitted appropriate mitigation measures are implemented.

# Section IV. Consideration For Other Storm-Petrel Species

This plan serves to summarize key published and unpublished information on ASSP for aiding conservation and management of this species. By identifying priority management, restoration and research need, greater cooperation will result between management agencies, researchers and advocacy groups. In addition, the implementation of this conservation plan will aid in the protection of Leach’s storm-petrels and black storm-petrels that breed at some of the same islands in California and Baja California as ASSP, as described briefly below.

## Leach’s Storm-Petrel

Leach’s storm-petrel is one of the most widespread nesting seabirds in the northern hemisphere (Huntington et al. 1996). In the Pacific Ocean, they breed from Japan, across the Aleutian Islands and south to central western Baja California, Mexico. The species has several phenotype variations as identified in Power & Ainley (1986) and include:

1. *O. leucorhoa leucorhoa*: breed from North Atlantic Ocean and eastern North Pacific Ocean from the Aleutians to the Farallones and perhaps as far south as the Channel Islands;
2. *O. l. chapmani*: breeds on the Coronado Islands and San Benito Islands; with intergrades of *leucorhoa* found from the Coronado Islands to the South Farallon Islands off central California (Howell et al. 2009 and Howell 2012).

In addition, there are two storm-petrels formerly classified as LHSP but the best available information indicates that they are separate species (Ainley 1980; Power & Ainley 1986; Birt & Friesen 2009). Both species breed at Guadalupe Island off Baja California and appear to have become differentiated by separate breeding schedules; *O. l. socorroensis* breeding in summer and *O. l. cheimomnestes* breeding in winter. Currently, the AOU Classification Committee is considering a proposal to split *socorroensis* and *cheimomnestes* from *O. leucorhoa* and officially recognize two new species (AOU Proposals 2016-C-15 from <http://checklist.aou.org/nacc/proposals/current_proposals.html> accessed 14 June 2016).

In California, LHSP breeding colonies occur throughout the State with the largest colonies occurring in northern California at Castle Rock (Del Norte County), Trinidad Bay Rocks and Little River Rock in 1989 (Carter et al. 1992). Recent assessments conducted by Parker et al. (2013) in 2012 indicated a substantial decline in breeding birds at Trinidad Bay Rocks and Little River Rock since 1989; only a few hundred birds likely remain at Trinidad Bay Rocks. In southern California, LHSP are known or suspected to breed on Prince Island, Santa Barbara Island, Sutil Island, and Santa Catalina Island, with a combined population estimate of less than 350 breeding birds (Carter et al. 1992, 2016a). In Baja California, LHSP are known to breed on Coronado Islands and San Benito Islands where population estimates are in the hundreds (Everett and Anderson 1991). At Guadalupe Island, Townsend’s Storm-Petrel has been estimated at around 7,000 birds (Crossin 1974) and Ainley’s Storm-Petrel is likely not in “excess of a few thousands birds” (Howell et al. 2009).

Goals and objectives in this ASSP Conservation Action Plan to conduct mist-net population estimates at Prince Island (San Miguel Island area), Santa Barbara Island, Sutil Island and Coronado Islands should include updating LHSP population estimates and assessing the current degree of intergrades. In addition, certain management actions geared toward ASSP that are implemented at breeding locations on the South Farallon Islands, Prince Island, Santa Barbara Island, Sutil Island, Santa Catalina Island and Coronado Islands will also benefit these populations of LHSP. Like ASSP, LHSP nest in rock crevices in the southern portion of their range from Central California (South Farallon Islands) to Guadalupe Island. However, conservation issues and efforts for the vulnerable populations of LHSP at Todos Santos Islands, San Benito Islands and Guadalupe Island are not identified in this ASSP conservation plan.

## Black Storm-Petrel

Black storm-petrels breed primarily on islands in the Gulf of California, Mexico and off the west coast of Baja California, on Coronado and San Benito islands (Everett & Anderson 1991; Howell 2009), extending north to Santa Barbara and Sutil islands off southern California (Carter et al. 1992). Everett and Anderson (1991) considered this species to be the second most abundant seabird in the Gulf of California while population numbers on the west coast of Baja California range from “200 to 300 birds” at Coronado Islands (Everett & Anderson 1991) to perhaps tens of thousands at San Benito Islands (Crossin 1974, Boswall 1978, Everett & Anderson 1991). However, lack of information provided by Crossin and Boswall on survey methods and the lack of information since these informal assessments were conducted gives good reason to look at this rough estimate cautiously. In California, Carter et al. (1992) estimated 200 and 74 breeding birds at Santa Barbara Island and Sutil Island, respectively.

Goals and objectives in this ASSP Conservation Action Plan to conduct mist-net population estimates at Santa Barbara Island, Sutil Island and Coronado Islands should include updating BLSP population estimates. At Prince Island, BLSP were found in small numbers in 1991 and may breed with ASSP and LHSP (Carter et al. 1992). In addition, certain management actions geared toward ASSP that are implemented at Prince Island, Santa Barbara Island, Sutil Island, and the Coronado Islands, will also benefit BLSP.

# Section V. References

ADAMS, J. 2016. Ashy Storm-Petrel *Oceanodroma homochroa* mist-netting and capture rates in the California Channel Islands: 2004-2007. *Marine Ornithology*, in press.

ADAMS, J. & TAKEKAWA, J.Y. 2008. At-sea distribution of radio-marked Ashy Storm-Petrels *Oceanodroma homochroa* captured on the California Channel Islands. *Marine Ornithology* 36: 9-17.

ADAMS, J., CARTER, H.R., MCCHESNEY, G.J., & WHITWORTH, D.L. 2016. Leach’s Storm-Petrel *Oceanodroma leucorhoa* in the California Channel Islands. *Marine Ornithology,* in prep.

AGUIRRE-MUÑOZ, A., SAMANIEGO-HERRERA, A., LUNA-MENDOZA, L., ORTIZ-ALCARAZ, A., RODRÍGUEZ- MALAGÓN, M., MÉNDEZ-SÁNCHEZ, F., FÉLIX-LIZÁRRAGA, M., HERNÁNDEZ-MONTOYA, J. C., GONZÁLEZ GÓMEZ, R., TORRES-GARCÍA, F., BARREDO-BARBERENA, J. M., & LATOFSKI-ROBLES, M. 2011. Island restoration in Mexico: ecological outcomes after systematic eradications of invasive mammals. In C. R. Veitch, M. N. Clout & D. R. Towns (Eds.), *Island Invasives: Eradication and Management. Proceedings of the International* *Conference on Island Invasives* (pp. 250-258). Occasional Paper of the IUCN Species Survival Commission No. 42. Gland, Switzerland and Auckland, New Zealand: IUCN and CBB.

AINLEY, D.G. 1976. The occurrence of seabirds in the coastal region of California. *Western Birds* 7: 33-68.

AINLEY, D.G. 1980. Geographic variation in Leach’s Storm-Petrel. *Auk* 97: 837-853.

AINLEY, D.G., HENDERSON, R.P. & STRONG, C.S. 1990. Leach’s Storm-Petrel and Ashy Storm-Petrel. In Ainley, D.G. & Boekelheide, R.J. (eds.). Seabirds of the Farallon Islands: ecology, dynamics, and structure of an upwelling-system community. Stanford, CA: Stanford University Press. pp.128-162.

AINLEY, D.G. & BOEKELHEIDE, R.J. (Eds.). 1990. Seabirds of the Farallon Islands: ecology, dynamics, and structure of an upwelling-system community. Stanford, CA: Stanford University Press.

AINLEY, D.G. & LEWIS, T.J. 1974. The history of Farallon Island marine bird populations, 1854-1972. *Condor* 76: 432-446.

AINLEY, D.G., LEWIS, T.J. & MORRELL, S. 1974. Patterns in the life histories of storm-petrels on the Farallon Islands. *Living Bird* 13: 295-312.

AINLEY, D.G. 1995. Ashy Storm‑Petrel (*Oceanodroma homochroa*). In Poole, A. (ed.). The Birds of North America Online. Ithaca, NY: Cornell Lab of Ornithology.

AINLEY, D.G. & HYRENBACH, D. 2010. Long- and short-term factors affecting seabird population trends along the California Current System. *Progress in Oceanography* 84:242-254.

ALLEN, S.G. 1994. The distribution and abundance of marine birds and mammals in the Gulf of the Farallones and adjacent waters, 1985-1992. PhD dissertation, University of California, Berkeley.

ANTHONY, A.W. 1898. Petrels of southern California.  *Auk* 15: 140-144.

BECKER, B.H., CARTER, H.R., HENDERSON, R.P., WEINSTEIN, A., & PARKER, M.W. 2016. Status and monitoring of Ashy Storm-Petrels *Oceanodroma homochroa* at Point Reyes National Seashore California, 2012-2015. *Marine Ornithology* (*in review)*.

BLAKE, E.W., Jr. 1887. Summer birds of Santa Cruz Island, California. Auk 4: 328-330.

BLIGHT, L.K., & BURGER, A.E. 1997. Occurrence of plastic particles in seabirds from the eastern North Pacific. *Marine Pollution Bulletin* 34: 323-325

BOARMAN, W.I. & COE, S.J. 2002. An evaluation of the distribution and abundance of Common Ravens at Joshua Tree National Park. Bulletin of the Southern California Academy of Sciences 101: 86-102.

BOSWALL, J. 1978. The birds of the San Benito Islands, Lower California, Mexico. *Bristol Ornithology* 11: 23-32.

BOULEY, P., ISADORE, M. & CARROLL, T. 2015. Return of North American river otters, *Lontra* c*anadensis*, to coastal habitats of the San Francisco Bay area, California. Northwestern Naturalist 96: 1-12.

BRADLEY, R. 2011. New assessment of Ashy Storm-Petrels on Farallon Islands. PRBO Conservation Science. 2p.

BRIGGS, K.T., TYLER, W.B., LEWIS, D.B. & CARLSON, D.R. 1987. Bird communities off California: 1975-1983. *Studies in Avian Biology* No. 11.

BRIDGES, A.S., SANCHEZ, J.N., & BITEMAN, D.S. 2015. Spatial ecology of invasive feral cats on San Clemente Island: implications for control and management. *Journal of Mammalogy* 96: 81-89.

BROOME, K. 2009. Beyond Kapiti - A decade of invasive rodent eradications from New Zealand islands. *Biodiversity, 10*(2-3):14-24.

BROWN, A., COLLIER, N., ROBINETTE, D. & SYDEMAN, W.J. 2003. A potential new colony of Ashy Storm-Petrels on the mainland coast of California, USA. *Waterbirds* 26: 385-388.

CARLE, R., BECK, J., CALLERI, D. & HESTER, M. 2014. Año Nuevo State Park Seabird Conservation and Habitat Restoration: Report 2014. Oikonos – Ecosystem Knowledge. 48 p.

CARTER, H.R., WHITWORTH, D.L., TAKEKAWA, J.Y., KEENY, T.W., & KELLY, P.R. 2000. At-sea threats to Xantus’s Murrelets (*Synthliboramphus hypoleucus*) in the southern California Bight, in Proceedings of the fifth California Islands symposium, 29 March to 1 April 1999 (D.R. Browne, K.L. Mitchell, and H.W. Chaney, eds.), pp. 435-447. U.S. Minerals Mgmt. Serv., Pacific Outer Continental Shelf Region, Camarillo, CA.

CARTER, H.R. 2001. Appendix B. Histories of Common Murre (*Uria aalge californica*) colonies in California, 1800-1978. In Manuwal, D.A., Carter, H.R., Zimmerman, T.S. & Orthmeyer, D.L. (eds.). Biology and conservation of the Common Murre in California, Oregon, Washington, and British Columbia. Vol. 1: Natural history and population trends. U.S. Geological Survey, *Information and Technology Report* USGS/BRD/ITR-200-0012. pp. 93-107.

CARTER, H.R., MCCHESNEY, G.J., JAQUES, D.L., STRONG, C.S., PARKER, M.W., TAKEKAWA, J.E., JORY, D.L. & WHITWORTH, D.L. 1992. Breeding populations of seabirds in California, 1989-1991. Volume I - Population estimates. Dixon, CA: Unpubl. draft report, U.S. Fish and Wildlife Service, Northern Prairie Wildlife Research Center.

CARTER, H.R., GRESS, F., WHITWORTH, D.L., PALACIOS, E., KOEPKE, J.S. & HARVEY, A.L. 2006a. Seabird monitoring at the Coronado Islands, Baja California, Mexico, in 2005. Davis, CA: Unpubl. report, California Institute of Environmental Studies. 110 p.

CARTER, H.R., WHITWORTH, D.L., NEWMAN, S.H., PALACIOS, E., KOEPKE, J.S., HÉBERT, P.N., & GRESS, F. 2006b. Preliminary assessment of the status and health of Xantus’s Murrelets (*Synthliboramphus hypoleucus*) at Todos Santos Islands, Baja California, Mexico, in 2005. Unpublished Report, California Institute of Environmental Studies, Davis, CA; and Wildlife Trust, New York, New York.

CARTER, H.R., MCIVER, W.R. & MCCHESNEY, G.J. 2008a. Ashy Storm-Petrel (*Oceanodroma homochroa*). In Shuford, W.D. & Gardali, T. (eds.). California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Camarillo, CA: Western Field Ornithologists; and Sacramento, CA: California Department of Fish and Game. pp. 117-124.

CARTER, H.R., YEE, J.L., WELSH, D. & ANDERSON, D.W. 2008b. Organochlorine contaminants in Ashy Storm-Petrel eggs from Santa Cruz Island, California, in 1992-2008: preliminary findings. Victoria, BC: Unpubl. report, Carter Biological Consulting; and Sacramento, CA: U.S. Geological Survey, Western Ecological Research Center. 10 p.

CARTER, H, WHITWORTH, D., HEBERT, P., KOEPKE, J., CAPITOLO, P., MCCHESNEY, G., MCIVER, W., OCHIKUBO CHAN, L., PIERSON, M., HEBSHI, A. & MARTIN, P. 2008c. Status of breeding seabirds in the San Miguel Island group, California. Victoria, BC: Unpubl. report, Carter Biological Consulting; and Davis, CA: California Institute of Environmental Studies. 131 p.

CARTER, H.R., WHITWORTH, D.L., MCIVER, W.R., MCCHESNEY, G.J., OCHIKUBO CHAN, L.K., GRESS, F. & HERBERT, P.N. 2009. Status of the Xantus’s Murrelet, Ashy Storm-Petrel, and Black Storm-Petrel at San Clemente Island, California. Victoria, B.C.: Unpubl. report, Carter Biological Consulting; and Davis, CA: California Institute of Environmental Studies. 42 p.

CARTER, H.R., PARKER, M.W., KOEPKE, J.S. & WHITWORTH, D.L. 2015. Breeding of the Ashy Storm-Petrel in central Mendocino County, California. *Western Birds* 46:49-65.

CARTER, H.R., AINLEY, D.G., WOLF, S.G. & WEINSTEIN, A.M. 2016a. Range-wide conservation and science of the Ashy Storm-Petrel *Oceanodrama homochroa*. *Marine Ornithology (in review).*

CARTER, H.R., DVORAK, T.M. & WHITWORTH, D.L. 2016b. Breeding of the Ashy Storm-Petrel at Santa Catalina Island, California. *Marine Ornithology (in review)*.

CARTER, H.R. & HENDERSON, R.P. 2015. Ashy Storm-Petrel monitoring at San Clemente island, California, in 2014. Unpublished report, California Institute of Environmental Studies, Davis, California. 28 p.

CARTER, H.R. & HENDERSON, R.P. 2016. Ashy Storm-Petrel monitoring at San Clemente Island, California, in 2015. Unpublished Report, California Institute of Environmental Studies, Davis, California. 26 p.

CROSSIN R.S., & BROWNELL, R.L. 1968. Preliminary report of Channel Islands survey. Eastern area cruise no. 41. Unpublished report. Smithsonian Institute, Washington, D.C. 12 pp.

CROSSIN, R.S. 1974. The storm-petrels (Hydrobatidae). Pp. 154-205 in: King, W.B. (ed.), Pelagic studies of seabirds in the central and eastern Pacific Ocean. Smithsonian *Contributions to Zoology* 158.

DAWSON, W.L. 1911. Another fortnight on the Farallones. *Condor* 13: 171-183.

DOUGHTY, R.W. 1971. San Francisco’s nineteenth-century egg basket: the Farallons. *Geographical Review* 61: 554-572.

ERICKSON, W.A. & HALVORSEN, W.L. 1990. Ecology and control of the roof rat (*Rattus rattus*) in Channel Islands National Park. Davis, CA: Unpubl. report, University of California, Coop. National Park Resources Study Unit, Tech. Report No. 38.

EVERETT, W.T., & ANDERSON, D.W. 1991. Status and conservation of the breeding seabirds on offshore Pacific islands of Baja California and the Gulf of California, in Seabird status and conservation: A supplement (J.P. Croxall, ed.), pp. 115-139. Int. Council Bird Preservation Tech. Pub. 11.

FAULKNER, K.R. & KESSLER, C.C. 2011. Live capture and removal of feral sheep from eastern Santa Cruz Island, California. Pp. 295-299. In Veitch, C.R., Clout, M.N., and Towns, D.R. (eds.). Island Invasives: eradication and management. IUCN. Gland, Switzerland.

FRY, D.M. 1994. Injury of seabirds from DDT and PCB residues in the Southern

California Bight ecosystem. Sacramento, CA: Unpubl. report, U.S. Fish and Wildlife Service.

HAMER, T., REED, M., COLCLAZIER, E., TURNER, K., AND DENIS, N. 2014. Nocturnal Surveys for Ashy Storm-Petrels (*Oceanodroma homochroa*) and Scripps’s Murrelet (*Synthliboramphus scrippsi*) at offshore oil production platforms, southern California. United States Department of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA. OCS Study BOEM 2014-013. 62 pp.

HARVEY, A.L., AUER, S.A., BARNES, K.W., MAZURKIEWICZ, D.M., CARTER, C.A., JACQUES, M.E., AND YAMAGIWA, A.A. 2013. Scripps’s Murrelet, Cassin’s Auklet, and Ashy Storm-Petrel colony monitoring and restoration activities on Santa Barbara Island, California in 2010-2011. Unpublished report prepared, California Institute of Environmental Studies. 81 p.

HARVEY, A.L., MAZURKIEWICZ, D.M., MCKOWN, M.W., CARTER, H.R., BARNES, K.W. & PARKER, M.W. 2016. First breeding record of the Ashy Storm-Petrel at Anacapa Island, California. *Marine Ornithology (in review).*

HOWALD, G., DONLAN, C.J., GALVÁN, J.P., RUSSELL, J.C., PARKES, J., SAMANIEGO, A., WANG, Y., VEITCH, D., GENOVESI, P., PASCAL, M., SAUNDERS, A., & TERSHY, B. 2007. Invasive Rodent Eradication on Islands. *Conservation Biology, 21*(5), 1258-1268.

HOWELL, S.N.G. & WEBB, S. 1995. A guide to the birds of Mexico and northern central America. Oxford University Press Inc., New York.

HOWELL, S.N.G., MCGRATH, T., HUNEFELD, W.T., & FEENSTRA, J.S. 2009. Occurrence and identification o f the Leach’s Storm-Petrel (*Oceanodroma leucorchoa*) complex off southern California. *North American Birds* 63: 540-549.

HOWELL, S.N.G. 2012. Petrels, albatrosses and storm-petrels of North America. Princeton, NJ: Princeton University Press.

HUNT, G.L., JR., PITMAN, R.L., NAUGHTON, M., WINNETT, K., NEWMAN, A., KELLY, P.R. & BRIGGS, K.T. 1979. Distribution, status, reproductive biology and foraging habits of breeding seabirds. In Summary of marine mammals and seabird surveys of the Southern California Bight area, 1975-1978. Vol. 3. Investigator’s reports, Part 3: Seabirds of the Southern California Bight, Book 2. Irvine, CA: Unpublished report, University of California.

HUNT, G.L., JR., PITMAN, & JONES H.L. 1980. Distribution and abundance of seabirds breeding on the California Channel Islands. In D.M. Power (ed.). The California islands: proceedings of a multidisciplinary symposium. Santa Barbara Museum of Natural History, Santa Barbara, California.

INGERSOLL, M. 1886. Nesting habits and egg of Ashy Petrel (*Cymochorea homochroa*). *Ornithologist and Oologist* 11:21.

IPCC. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland. 112 p.

INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE (IUCN). 2016. The IUCN Red List of Threatened Species. Version 2015.4. <[www.iucnredlist.org](http://www.iucnredlist.org)>. Downloaded on 25 January 2016.

JANIKSKEE, B. 2010. Creature feature: the common raven is an uncommonly intelligent bird. [http://www.nationalparkstraveler.com/2010/06/creature-feature-common-raven-uncommonly-intelligent-bird5933. Accessed January 26](http://www.nationalparkstraveler.com/2010/06/creature-feature-common-raven-uncommonly-intelligent-bird5933.%20Accessed%20January%2026), 2016.

JAMES-VEITCH, E.A.T.C. 1970. The Ashy Petrel, *Oceanodroma homochroa*, at its breeding grounds on the Farallon Islands. Doctoral dissertation, Loma Linda University, Los Angeles, California.

JOYCE, T.W., MOORE, J.E., PITMAN, R.L., & BALANCE, L.T. 2016. Estimating abundance and trends of *Procellariiform* seabirds using Bayesian state-space models and at-sea data. Oral Presentation at Pacific Seabird Group Meeting, O’ahu, Hawai’i, 13 February 2016.

KIFF, L.F. 1994. Eggshell thinning in birds of the California Channel Islands. Sacramento, CA: Unpublished report, U.S. Fish and Wildlife Service.

LOOMIS, L.M. 1918. A review of the albatrosses, petrels, and diving petrels. *Proceedings of the California Academy of Sciences* (4th series) 2 (part 2, no. 12): 1–187.

LUNA-MENDOZA, L., BARREDO-BARBERENA, J. M., HERNÁNDEZ-MONTOYA, J.C., AGUIRRE-MUÑOZ, A., MÉNDEZ-SÁNCHEZ, F., ORTIZ-ALCARAZ, A., & FÉLIX-LIZÁRRAGA, M. 2011. Planning for the eradication of feral cats on Guadalupe Island, México: home range, diet, and bait acceptance. In C. R. Veitch, M. N. Clout & D. R. Towns (Eds.), Island Invasives: Eradication and Management. Proceedings of the International Conference on Island Invasives (pp. 192-197). Occasional Paper of the IUCN Species Survival Commission No. 42. Gland, Switzerland and Auckland, New Zealand: IUCN and CBB.

MANUWAL, D.A. 1974. Effects of territoriality on breeding in a population of Cassin’s Auklet. *Ecology* 55: 1399-1406.

MARZLUFF, J.M. & ANGELL, T. 2005. In the company of Crows and Ravens. Yale University Press, New Haven Connecticut.

MARZLUFF, J.M. & NEATHERLIN, E. 2006. Corvid response to human settlements and campgrounds: causes, consequences, and challenges for conservation. *Biological Conservation* 130: 301-314.

MASON, J.W., MCCHESNEY, G.J., MCIVER, W.R., CARTER, H.R., TAKEKAWA, J.Y., GOLIGHTLY, R.T., ACKERMAN, J.T., ORTHMEYER, D.L., PERRY, W.M., YEE, J.L., PIERSON, M.O. & MCCRARY, M.D. 2007. At-sea distribution and abundance of seabirds off southern California: a 20-year comparison. *Studies in Avian Biology* No. 33.

MATO, Y., TOMOHIKO, I., TAKADA, H., KANEHIRO, H., OHTAKE, C. & KAMINUMA, T. 2001. Plastic resin pellets as transport medium for toxic chemicals in the marine environment. *Environmental Science and Technology* 35: 318-324.

MCCHESNEY, G.J. 1988. Mark-recapture population estimates and diet of Ashy and Leach’s storm-petrels on Southeast Farallon Island, California 1987. B.A. thesis, University of California, Santa Cruz.

MCCHESNEY, G.J., CARTER, H.R. & PARKER. 1994. Report on an investigation of the North Farallon Islands, Farallon National Wildlife Refuge, California, 2 September 1994. Unpubl. report to the U.S. Fish and Wildlife Service. U.S. Geological Survey, Dixon, CA.

MCCHESNEY, G.J., CARTER, H.R. & PARKER, M.W. 2000. Nesting of Ashy Storm-Petrels and Cassin’s Auklets in Monterey County, California. *Western Birds* 31: 178-183.

MCIVER, W.R. & CARTER, H.R. 1996. Breeding phenology and success of the Ashy Storm-

Petrel at Santa Cruz Island, California: 1996 data collection protocol. Unpublished report, National Biological Service, California Science Center, Dixon, California. 7 p.

MCIVER, W.R. & CARTER, H.R. 1998. Database management for breeding phenology and

success of the Ashy Storm-Petrel at Santa Cruz Island, California, 1995-1997. Unpublished report, National Biological Service, California Science Center, Dixon, California. 17 p.

MCIVER, W.R. 2002. Breeding phenology and reproductive success of Ashy Storm-Petrels (*Oceanodroma homochroa*) at Santa Cruz Island, California, 1995-98. Arcata, CA: M.Sc. thesis, Humboldt State University. 70 p.

MCIVER, W.R. & CARTER, H.R. 2006. Nest surveys and monitoring of Ashy Storm-Petrels at Santa Cruz Island, California: 2005 progress report. Unpublished report, Carter Biological Consulting, Victoria, British Columbia. 6 p.

MCIVER, W.R., CARTER, H.R., GOLIGHTLY, R.T., MCCHESNEY, G.J., WELSH, D. & HARVEY, A.L. 2009a. Reproductive performance of Ashy Storm-Petrels (*Oceanodroma homochroa*) at Santa Cruz Island, California, in 1995-2007. In Damiani, C.C. & Garcelon, D.K. (eds.). Proceedings of the 7th California Islands Symposium. Arcata, CA: Institute for Wildlife Studies. pp. 269-281.

MCIVER, W.R., HARVEY, A.L., & CARTER, H.R. 2009b. Monitoring and restoration of Ashy Storm-Petrels at Santa Cruz Island, California, in 2008. Unpublished report, U.S. Fish and Wildlife Service, Arcata, California; Channel Islands National Park, Ventura, California; and Carter Biological Consulting, Victoria, British Columbia. 30 p.

MCIVER, W.R., HARVEY, A.L., CARTER, H.R., & HALPIN, L.R. 2011. Monitoring and restoration of Ashy Storm-Petrels at Santa Cruz Island, California, in 2010. Unpublished report, U.S. Fish and Wildlife Service, Arcata, California; Channel Islands National Park, Ventura, California; Carter Biological Consulting, Victoria, British Columbia; and Simon Fraser University, Burnaby, British Columbia. 45p. + appendices.

MCIVER, W.R., HARVEY, A.L., & CARTER, H.R. 2013. Monitoring and restoration of Ashy Storm-Petrels at Santa Cruz Island, California, in 2011. Unpublished report, U.S. Fish and Wildlife Service, Arcata, California; California Institute of Environmental Studies, Davis, California; and Carter Biological Consulting, Victoria, British Columbia. 58 p.

MCIVER, W.R., HARVEY, A.L., & CARTER, H.R. 2014. Monitoring and restoration of Ashy Storm-Petrels at Santa Cruz Island, California, in 2012. Unpublished report, U.S. Fish and Wildlife Service, Arcata, California; California Institute of Environmental Studies, Davis, California; and Carter Biological Consulting, Victoria, British Columbia. 50 p.

MCIVER, W.R., MAZURKIEWICZ, D.M., & HOWARD, J.A. 2015. Monitoring and restoration of Ashy Storm-Petrels at Santa Cruz Island, California, in 2013. Unpublished report,

U.S. Fish and Wildlife Service, Arcata, California; Montrose Settlements Restoration Program, Channel Islands National Park, Ventura California; and California Institute of Environmental Studies, Davis, California. 49 p.

MCIVER, W.R., CARTER, H.R., HARVEY, A.L., MAZURKIEWICZ, D.M. & MASON, J.W. 2016. Use of artificial nest structures and vocalization broadcasting to restore Ashy Storm-Petrels *Oceanodroma homochroa* at Orizaba Rock, Santa Cruz Island, California. *Marine Ornithology (in review).*

MILLS, K.L. 2016. Seabirds as part of migratory owl diet on Southeast Farallon Island, California. *Marine Ornithology*, in press.

MILLS, K.L., PYLE, P. SYDEMAN, W.J., & RAUZON, M.J. 2002. Direct and indirect effects of house mice on declining populations of a small seabird, the ashy storm-petrel (*Oceanodrama homochroa*) on Southeast Farallon Island, California. *In* Turning the tide: the eradication of invasive species. IUCN, Gland, Switzerland.

MONTROSE SETTLEMENTS RESTORATION PROGRAM (MSRP). 2005. Final restoration plan and programmatic environmental impact statement, and environmental impact report. Unpublished report, Montrose Settlements Restoration Program, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, National Park Service, California Department of Fish and Game, California Department of Parks and Recreation, and California State Lands Commission.

NATIONAL AUDUBON SOCIETY. 2006. America’s top ten most endangered birds: A March 2006 report from the National Audubon Society. Washington, D.C. 16 pp.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE (NCCOS). 2003. A Biogeographic Assessment off North/Central California: To Support the Joint Management Plan Review for Cordell Bank, Gulf of the Farallones, and Monterey Bay, National Marine Sanctuaries: Phase I – Marine Fishes, Birds and Mammals. Prepared by NCCOS’s Biogeography Team in cooperation with the National Marine Sanctuary Program. Silver Spring, MD 145pp.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE (NCCOS). 2007. A Biogeographic Assessment off North/Central California: In Support of the National Marine Sanctuaries of Cordell Bank, Gulf of the Farallones and Monterey Bay. Phase II – Environmental Setting and Update to Marine Birds and Mammals. Prepared by NCCOS’s Biogeography Branch, H.T. Harvey & Associates, R.G. Ford Consulting Co. and Oikonos Ecosystem Knowledge, in cooperation with the National Marine Sanctuary Program. Silver Spring, MD. NOAA Technical Memorandum NOS NCCOS 40. 240 pp.

NOGALES, M., MARTÍN, A., TERSHY, B., DONLAN, J., VEITCH, D., PUERTA, N., WOOD, B., & ALONSO, J. 2004. A review of feral cat eradication on islands. Conservation Biology, 18 (2): 310-319.

NORMA Oficial Mexicana NOM-059-SEMARNAT-2010, Protección ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para su inclusión, exclusión o cambio-Lista de especies en riesgo. México, D.F.

NUR, N., & SYDEMAN, W.J. 1999. Demographic processes and population dynamic models of seabirds: Implications for conservation and restoration. *Current Ornithology* 15: 149-188.

NUR, N., BRADLEY, R., SALAS, L., & JAHNCKE, J. 2013. Modeling the impacts of house mouse eradication on Ashy Storm-Petrels on Southeast Farallon Island. Unpublished report to the U.S. Fish and Wildlife Service. PRBO Conservation Science, Petaluma, California. PRBO Contribution Number 1880.

NUR, N., BRADLEY, R., SALAS, L., & JAHNCKE, J. In review. Evaluating population impacts of reduced predation by owls on storm petrels as a consequence of proposed island mouse eradication.

OBERBAUER, T. A. 1999a. Vegetation and flora of Islas los Coronados Baja California, Mexico. In: Fifth California Islands Symposium, ed. Browne, D. R.; Mitchell, K.L. and Chaney, H. W. pp 212-223. Camarillo, CA, USA: United States Minerals Management Service.

OBERBAUER, T.A. 1999b. Analysis of vascular plant species diversity of the pacific coast islands of Alta and Baja California. In: Fifth California Islands Symposium, ed. Browne, D. R.; Mitchell, K.L. and Chaney, H. W. pp201-211. Camarillo, CA, USA: United States Minerals Management Service.

PARKER, M.W., CARTER, H.R., & WHITWORTH, D.W. 2013. Preliminary assessment of burrow and crevice breeding habitats for storm-petrels and alcids on rocks near Trinidad, California, in 2012. Unpublished report, California Institute of Environmental Studies, Davis, California. 100p.

PENNIMAN, T.M., COULTER, M.C., SPEAR, L.B., & BOEKELHEIDE, R.J. 1990. Western Gull. In Ainley, D.G. & Boekelheide, R.J. (eds.). Seabirds of the Farallon Islands: ecology, dynamics, and structure of an upwelling-system community. Stanford, CA: Stanford University Press. pp.218-244.

REMSEN, J.V. 1978. Bird species of special concern in California: An annotated list of declining or vulnerable bird species. Nongame Wildlife Investigation, Wildlife Management Branch Administrative Report 78-1. California Department of Fish and Game, Sacramento, CA. 67 p.

ROBERSON, D. 1985. Monterey Birds. Monterey Peninsula Audubon Society, Pacific Grove, CA.

ROEMMICH, D., & MCGOWAN. 1995. Climatic Warming and the decline of zooplankton in the California Current. *Science* 267: 1324-1326.

RUSSELL, J. C., TOWNS, D.R., & CLOUT, M.N. 2008. Review of rat invasion biology: Implications for island biosecurity. (pp. 1-53).

SAN FRANCISCO CALL. 1895. First cargo of Guano. October 11, 1895. Page 3. Accessed on 26 January 2016 at: http://chroniclingamerica.loc.gov/lccn/sn85066387/1895-10-11/ed-1/seq-3/.

SCHUYLER, P. 1993. Control of feral sheep (*Ovis aries*) on Santa Cruz Island, California. Pages 443-452 *in* Hochberg, F.G. (ed.). The third California Islands symposium: recent advances in research on the California Islands. Santa Barbara Museum of Natural History, Santa Barbara, California.

SEMARNAT. 2010. Proteción ambiental-Especies nativas de México de flora y fauna silvestres-Categorías de riesgo y especificaciones para inclusion, exclusion o cambio-Lista de species en riesgo.

SCHUITEMAN, M.A. 2006. Intra- and inter-annual breeding season diet of Leach’s storm-petrel (*Oceanodroma leucorhoa*) at a colony in southern Oregon. M.S., University of Oregon, Oregon Institute of Marine Biology, Charleston, Oregon. 56 p.

SOWLS, A.L., DEGRANGE, A.R., NELSON, J.W., & LESTER, G.S. 1980. Catalog of California seabird colonies. United States Department of Interior, Fish and Wildlife Service, Biological Services Program. FWS/OBS 37/80. 317 p.

SPEAR, L.B., AINLEY, D.G., RIBIC, C.A. 1995. Incidence of plastic in seabirds from the tropical Pacific, 1984-91: relation with distribution of species, sex, age, season, year and body weight. Marine Environ. Res. 40: 123-146.

SPEAR, L.B., AINLEY, D.G., HARESTY, B.D., HOWELL, S.N.G. & WEBB, S.W. 2004. Reducing biases affecting at-sea surveys of seabirds: use of multiple observer teams. *Marine Ornithology* 32: 147-157.

SPEAR, L.B. & AINLEY, D.G. 2007. Storm-petrels of the eastern Pacific Ocean: species assembly and diversity along marine habitat gradients. *Ornithological Monographs* No. 62.

STALLCUP, R.W. 1976. Pelagic birds of Monterey Bay, California. *Western Birds* 7: 113-136.

SYDEMAN, W.J., NUR, N., MCLAREN, E.B. & MCCHESNEY, G.J. 1998. Status and trends of the Ashy Storm-Petrel on Southeast Farallon Island, California, based upon capture-recapture analyses. *Condor* 100:438-447.

THOMSEN, S.K. & PLUMB, S. 2014. Factors influencing depredation of Scripps’s Murrelets by Barn Owls on Santa Barbara Island: Summary Results from the 2012 field season. Unpublished report prepared for: Montrose Settlements Restoration Program. 15 p.

U.S. FISH & WILDLIFE SERVICE (USFWS). 2002. Birds of conservation concern 2002. Arlington, VA: U.S. Fish and Wildlife Service, Division of Migratory Bird Management.

U.S. FISH & WILDLIFE SERVICE. 2005. Regional Seabird Conservation Plan, Pacific Region. U.S. Fish and Wildlife Service, Migratory Birds and Habitat Programs, Pacific Region, Portland, OR.

U.S. FISH & WILDLIFE SERVICE (USFWS). 2009a. Endangered and threatened wildlife and plants; 12-month finding on a petition to list the Ashy Storm-Petrel as threatened or endangered. Notice of 12–month petition finding. *Federal Register* 74: 41832-41860.

U.S.FISH & WILDLIFE SERVICE (USFWS). 2009b. Farallon National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment. U.S. Fish & Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Newark, CA.

U.S. FISH & WILDLIFE SERVICE (USFWS). 2013a. Endangered and threatened wildlife and plants; 12-Month finding on a petition to list Ashy Storm-Petrel as an endangered or threatened species. Notice of 12–month petition finding. *Federal Register* 78: 62523-62529.

U.S. FISH & WILDLIFE SERVICE (USFWS). 2013b. South Farallon Islands Invasive House Mouse Eradication Project: Revised Draft Environmental Impact Statement. U.S. Fish & Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Fremont, CA.

U.S. FISH & WILDLIFE SERVICE (USFWS). 2016. Endangered and threatened species: San Miguel Island fox, Santa Rosa Island fox, Santa Cruz Island fox, Santa Catalina Island fox. Final Rule. *Federal Register* 81: 53315-53333

U.S. NAVY. 2015. Explosive safety risk assessment for San Miguel & Prince Island. Naval Base Ventura County. 165 p.

VEITCH, C. R., & CLOUT, M.N. (EDS.). 2002. Turning the Tide: The Eradication of Invasive Species. Proceedings of the International Conference on Eradication of Island Invasives. Occasional Paper of the IUCN Species Survival Commission No. 27. Gland, Switzerland: IUCN.

VEITCH, C. R., CLOUT, M.N., & TOWNS, D.R. (EDS.). 2011. Island Invasives: Eradication and Management. Proceedings of the International Conference on Island Invasives. Occasional Paper of the IUCN Species Survival Commission No. 42. Gland, Switzerland and Auckland, New Zealand: IUCN and CBB.

WARZYBOK, P., BERGER, R., & BRADLEY, R.W. 2015. Population size and reproductive performance of seabirds on Southeast Farallon Island, 2015. Unpubl. report to the U.S. Fish and Wildlife Service, Farallon National Wildlife Refuge. Point Blue Conservation Science, Petaluma, California.

WHITE, P. 1995. The Farallon Islands: sentinels of the Golden Gate. San Francisco, CA: Scottwall Associates.

WHITWORTH, D.L., CARTER, H.R., YOUNG, R.J., MCCHESNEY, G.J., HESTER, M. & ALLEN S. 2002. Status and distribution of the Ashy Storm-Petrel (*Oceanodroma hochroa*) at Point Reyes National Seashore, California, in 2001. Unpublished report, Humboldt State University, Department of Wildlife, Arcata, California. 15 p.

WHITWORTH, D.L., HARVEY, A.L. & CARTER, H.R. 2011. Cassin’s Auklets, Xantus’s Murrelet and other crevice-nesting seabirds at Santa Barbara Island, California: 2009-2010 Surveys. Unpublished report, California Institute of Environmental Studies, Davis, California; Channel Islands National Park, Ventura, California; and Carter Biological Consulting, Victoria, British Columbia. 84 p.

WHITWORTH, D.L., CARTER, H.R. & GRESS, F. 2013. Recovery of a threatened seabird after eradication of an introduced predator: eight years of progress for Scripps's Murrelet at Anacapa Island, California. *Biological Conservation* 162:52-59.

WHITWORTH, D.L., HARVEY, A.L., CARTER, H.R., YOUNG, R.J., KOEPKE, J.S., & MAZURKIEWICZ, D.M. 2105. Breeding of Cassin’s Auklet *Ptychoramphus aleuticus* at Anacapa Island, California, after eradication of Black Rats *Rattus rattus*. Marine Ornithology 43: 19-24.

WOLF, S., ROTH, J.E., SYDEMAN, W.J. & MARTIN, P.L. 2000. Population size, phenology and productivity of seabirds on Santa Barbara Island, 1999. Channel Islands National Park Technical Report CHIS 00-02. 68 p.

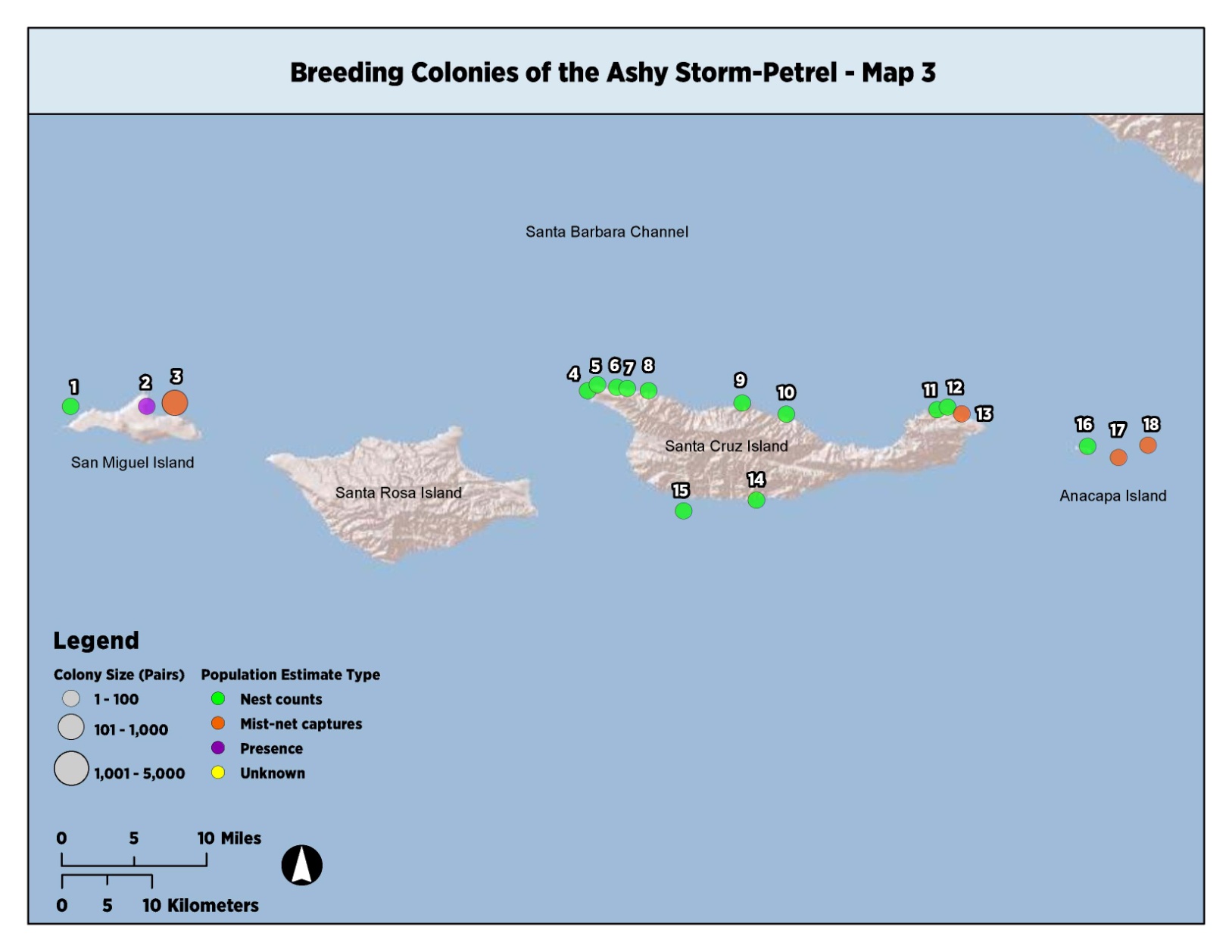
WOLF, S. 2007. Petition to list the Ashy Storm-Petrel (*Oceanodroma homochroa*) as a threatened or endangered species under the Endangered Species Act. Center for Biological Diversity, Fallbrook, California. 51 p.

# ASSP_Sightings.jpgFigure 1. Distribution of ashy storm-petrels in the eastern North Pacific Ocean. Data were obtained from at-sea surveys by eight research and monitoring programs including: 1. California Co-operative Oceanic Fisheries Investigation (CalCOFI, 1997-2007); 2. National Marine Fisheries Service California Current Ecosystem Study (National Marine Fisheries Service NMFS CCES - National Oceanic and Atmospheric Administration [NOAA]; 2006-2008); 3. California Current Cetacean & Ecosystem Assessment Surveys (NOAA Southwest Fisheries Science Center; 2001-2008; 4. Line P and other North Pacific surveys (Canadian Wildlife Service [CWS] and Environment Canada; 1997-2010); 5. NMFS Rockfish Surveys (1998-2009); 6. NMFS Sardine Surveys (2006-2008); 7. Global Ocean Ecosystem Dynamics Northeast Pacific Northern California Current (GLOBEC NEP NCC; 2000-2002); and 8. Ocean Salmon Ecology (OSE), Southern Resident Killer Whale (SRKW) and Ships-of-Opportunity (SoO) surveys (NOAA Northwest Fisheries Science Center; 2003-2012). Map produced by Dori Dick, Point Blue Conservation Science.

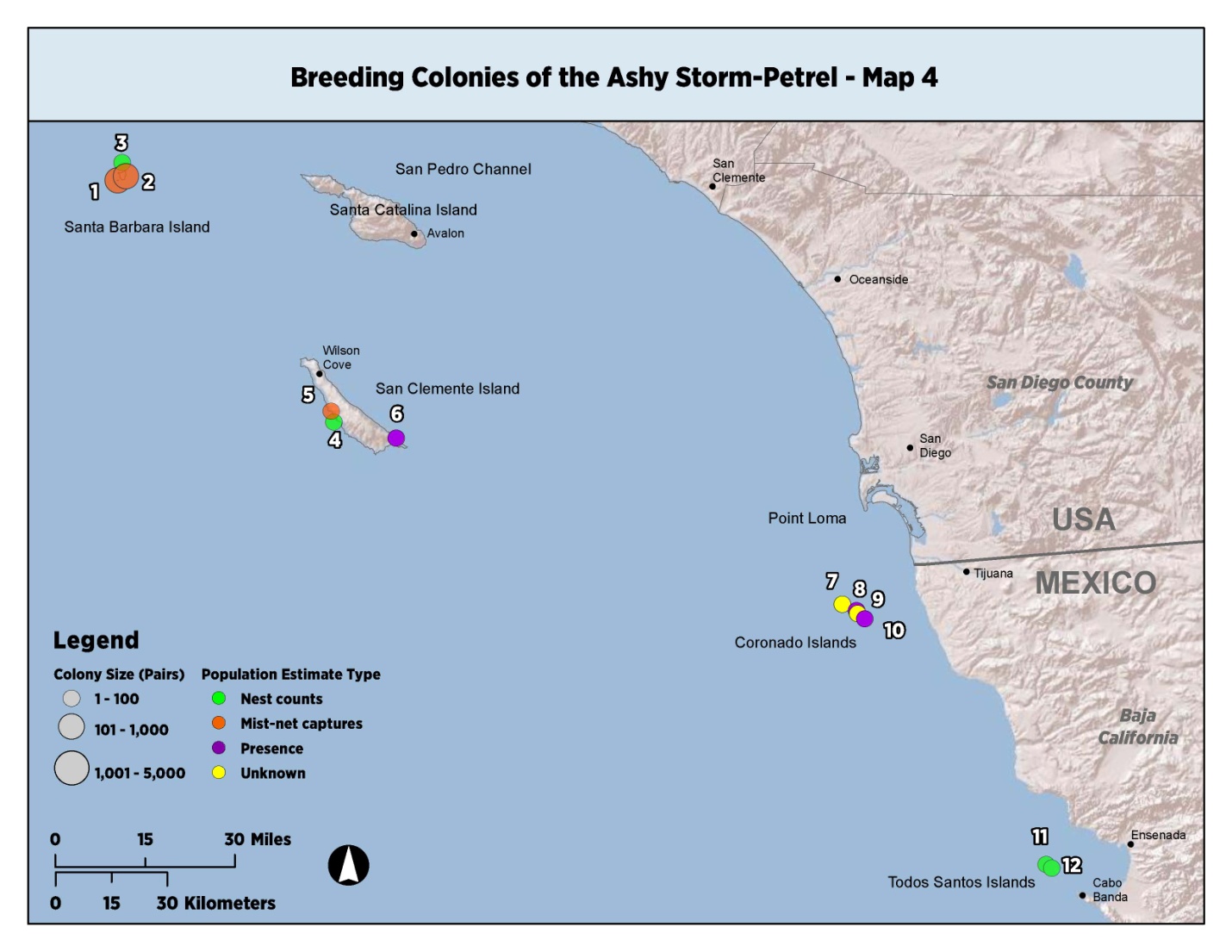
# Ashy Storm-Petrel Breeding Distribution (portrait) - Overview - Update 2015 v3.jpgFigure 2. Map of Ashy Storm-Petrel breeding distribution in California and Mexico.

# Ashy Storm-Petrel Breeding Distribution (portrait) - Map 1 - Update 2015 v3.jpgFigure 3. Map of Ashy Storm-Petrel breeding distribution in Mendocino, Sonoma, Marin, San Mateo and northern Santa Cruz counties, California.

# Ashy Storm-Petrel Breeding Distribution (portrait) - Map 2 - Update 2015 v3.jpgFigure 4. Map of Ashy Storm-Petrel breeding distribution in southern Santa Cruz, Monterey, San Luis Obispo and Santa Barbara counties, California.



# Figure 5. Map of the Ashy Storm-Petrel breeding distribution on San Miguel, Santa Rosa, Santa Cruz and Anacapa islands, California.



# Figure 6. Map of Ashy Storm-Petrel Santa Barbara, Santa Catalina, and San Clemente islands, California, USA and Coronado, Todos Santos islands, Baja, Mexico.

# Table 1. Breeding population estimates for ashy storm-petrels.

| **Colony Name** | **Map No. – Location No.** | **Most Recent**  **Survey Year for Estimate** | **Survey**  **Method1** | **No. of**  **Breeding Pairs11** | **Population Size Category**  **(Pairs)11** | **Source** |
| --- | --- | --- | --- | --- | --- | --- |
| ***Humboldt and Mendocino County Coast*** | | | | | | |
| Steamboat Rock | unmapped | 1914 | EC | X | X | Carter et al. 2016 |
| Kibesillah Rock | 1-1 | 2012 | NS | P | P | Carter et al. 2015a |
| Casper-Point Cabrillo Rock | 1-2 | 1926 | EC | X | X | Carter et al. 2015a |
| Stillwell Point Rock | 1-3 | 2012 | NS | 1-102 | 1-100 | Carter et al. 2015a |
| Casket Rock | 1-4 | 2012 | NS | 1-102 | 1-100 | Carter et al. 2015a |
| Wharf Rocks | 1-5 | 2012 | NS | 1-102 | 1-100 | Carter et al. 2015a |
| Franklin Smith Rock | 1-6 | 2012 | NS | 1-202 | 1-100 | Carter et al. 2015a |
| *Subtotal* |  |  |  | *4-50* |  |  |
| ***Point Reyes National Seashore*** | | | | | | |
| Bird Rock | 1-7 | 2015 | NS | 5-10 | 1-100 | Becker et al. 2016 |
| Point Reyes Lighthouse | 1-8 | 2013 | MN | P | P | Becker et al. 2016 |
| Chimney Rock | 1-9 | 2001 | MN | P | P | Becker et al. 2016 |
| Stormy Stack | 1-10 | 2015 | NS | 10-15 | 1-100 | Becker et al. 2016 |
| *Subtotal* |  |  |  | *15-25* | *1-100* |  |
| ***Golden Gate Area*** | | | | | | |
| Steep Ravine | 1-11 | 2001 | V | P | P | Whitworth et al. 2002 |
| Alcatraz Island | 1-12 | 2014 | DB | P | P | Carter et al. 2015b |
| *Subtotal* |  |  |  | P |  |  |
| ***San Mateo County Coast*** | | | | | | |
| San Pedro Rock | 1-13 | 1998 | NS | P | P | USFWS, unpubl. data |
| Año Nuevo Island | 1-14 | 2005 | MN | P | P | Carle et al. 2014 |
| *Subtotal* |  |  |  | P |  |  |
| ***South Farallon Islands*** | | | | | | |
| SE Farallon Island | 1-15 | 2010-2012 | MN | 2,884 | 1,001-5,000 | Nur et al. 2013 |
| West End Island | 1-16 | ? | MN | P? | P? | Carter et al. 1992 |
| Islets | 1-17 | ? | MN | P? | P? | Carter et al. 1992 |
| *Subtotal* |  |  |  | *2,884* | *1001-5000* |  |
| ***Monterey County Coast*** | | | | | | |
| Bench Mark-227x | 2-1 | 1997 | NS | 2-102,6 | 1-100 | McChesney et al. 2000 |
| Castle Rocks and Mainland | 2-2 | 1997 | NS | 1-52,6 | 1-100 | McChesney et al. 2000 |
| Hurricane Point Rocks | 2-3 | 1997 | NS | 1-152,6 | 1-100 | McChesney et al. 2000 |
| *Subtotal* |  |  |  | *4-30* | *1-100* |  |
| ***Northern Santa Barbara County Coast*** | | | | | | |
| Vandenberg Air Force Base | 2-4 | 2001 | MN | P | P | Brown et al. 2003 |
| ***San Miguel Island*** | | | | | | |
| Castle Rock | 3-1 | 1968 | NS | 1003 | 1-100 | Crossin and Brownell 1968 |
| San Miguel Island (Harris Point to Cuyler Harbor) | 3-2 | 1976 | MN | P | P |  |
| Prince Island | 3-3 | 1991 | MN | 577 | 101-1,000 | Carter et al. 1992 |
| *Subtotal* |  |  |  | *677* | *101-1000* |  |
| ***Santa Cruz Island*** | | | | | | |
| Shipwreck Cave | 3-4 | 1997 | NS | 74 | 1-100 | H.R. Carter, unpubl. data |
| Dry Sandy Beach Cave | 3-5 | 2010 | NS | 294 | 1-100 | McIver et al. 2011 |
| Del Mar Rock | 3-6 | 1991 | NS | 15 | 1-100 | Carter et al. 1992 |
| Cave of the Bird’s Eggs | 3-7 | 2014 | NS | 30 | 1-100 | W.R. McIver and  D. Mazurkiewicz, unpubl. data |
| Painted Cave | 3-8 | 1994 | NS | 05 | 0 | H.R. Carter, unpubl. data |
| Diablo Rocks | 3-9 | 1994 | NS | 45 | 1-100 | H.R. Carter, unpubl. data |
| Orizaba Rock | 3-10 | 2014 | NS | 324 | 1-100 | W.R. McIver and  D. Mazurkiewicz, unpubl. data |
| Bat Cave | 3-11 | 2014 | NS | 924 | 1-100 | W.R. McIver and  D. Mazurkiewicz, unpubl. data |
| Cavern Point Cove Caves | 3-12 | 2014 | NS | 54 | 1-100 | W.R. McIver and  D. Mazurkiewicz, unpubl. data |
| Scorpion Rocks | 3-13 | 1991 | MN | 707 | 1-100 | Carter et al. 1992 |
| Willows Anchorage Rocks | 3-14 | 1991 | SC | 56 | 1-100 | Carter et al. 1992 |
| Gull Island | 3-15 | 1991 | NS | 14,8 | 1-100 | Hunt et al. 1979 |
| *Subtotal* |  |  |  | *327* | *101-1000* |  |
| ***Santa Barbara Island*** | | | | | | |
| Sutil Island | 4-1 | 1991 | MN | 293 | 101-100 | Carter et al. 1992 |
| SBI (main island) | 4-2 | 1991 | MN | 437 | 101-100 | Carter et al. 1992 |
| Shag Rock | 4-3 | 1996 | NS | 15 | 1-100 | H.R. Carter, unpubl. data |
| *Subtotal* |  |  |  | *731* | *101-1000* |  |
| ***San Clemente Island*** | | | | | | |
| Seal Cove South Rock | 4-4 | 2015 | NS | 2 | 1-100 | Carter and Henderson 2016 |
| Seal Cove Cliffs | 4-5 | 2015 | MN | 33-43 | 1-100 | Carter and Henderson 2016 |
| Knob Canyon | 4-6 | 2013 | MN | P | P | Carter and Henderson 2016 |
| *Subtotal* |  |  |  | *35-45* | *1-100* |  |
| ***Coronado Islands10*** | | | | | | |
| North Island | 4-7 | ? | ? | ? | ? |  |
| Middle Rock | 4-8 | 2005 | NS | X | X | Everett and Anderson 1991 |
| Middle Island | 4-9 | ? | ? | ? | ? |  |
| South Island | 4-10 | 2005 | NS | ? | ? | Everett and Anderson 1991 |
|  | *Subtotal* |  |  |  | ? | ? |  |
| ***Todos Santos Islands*** | | | | | | |
| North Island | 4-11 | 2015 | NS | 5 | 1-100 | Bedolla-Guzmán, GECI, unpubl. data |
| South Island | 4-12 | 2015 | NS | 12 | 1-100 | Bedolla-Guzmán, GECI, unpubl. data |
| *Subtotal* |  |  |  | 17 | *1-100* |  |
| ***All Known Breeding Sites*** | | | | | | |
| **Totals** |  |  |  | *4,694-4,786* |  |  |

|  |
| --- |
|  |

1 NS, nest search; MN, mist-net captures with estimates based on mark-recapture data; SC, site count; V, vocalizing heard only; DB, dead bird only; EC, egg collection.

2 Low end of range = number of nests found; high end of range = estimated number of pairs.

3 Rough estimate of “several hundred birds”. One nest was found in October 1991.

4 Complete nest count in all suitable nesting habitat.

5 Incomplete nest count with some inaccessible habitat.

6 Estimate of 10-30 breeding pairs divided into nearby colonies based on nests found and amount of suitable habitat.

7 No nests were found in 1991 but most of this colony is inaccessible. In recent years, a couple of nests have been

found on Scorpion Rock (D.M. Mazurkiewicz, unpubl. data).

8 No nests were found during a nest search in October 1991 but eggshells may have been missed (Carter et al. 1992).

9 Past breeding by small numbers.

10 22 storm-petrel nests were found on the Coronado Islands in 2015 but species identification could not be confirmed. Work to confirm species identification will continue in 2016 and beyond.

11Symbol definitions: X= a confirmed nesting location as a nesting bird or egg was documented at the location but no population estimates have been made for the location; P=Only presence was noted and no population estimate provided (scent or calls heard); P?=presence likely due to proximity to a major colony but no nest documented; ? information unavailable for this location but storm-petrel species have been documented and ASSP possibly occur at the location.

# Table 2. Potential threats to Ashy Storm-Petrels.

|  |  |
| --- | --- |
| THREAT | LOCATION WHERE THREAT IS PRESENT |
| Climate Change: Warming: Increased El Niño years and decreased ocean productivity | Entire Range |
| Climate Change: Ocean acidification | Entire Range |
| Climate Change: Sea level rise | Low lying nest locations, particularly sea caves (e.g., Santa Cruz Island) and low lying islets (e.g., Orizaba Rock) |
| Human presence | Entire Range except SE Farallon Island |
| Introduced non-native vegetation (e.g., New Zealand spinach) | SE Farallon Island – may occur elsewhere |
| Military Activities | San Clemente Island, Seal Cove Rocks |
| Scientific purposes | Everywhere nests are accessible |
| Recreational purposes | All locations, except for SE Farallon Island |
| Burrowing Owl predation | SE Farallon Island |
| Western Gull predation | SE Farallon Island, Santa Barbara Island, Santa Cruz Island and Todos Santos Island – may occur elsewhere |
| Mouse predation | Santa Cruz Island, SE Farallon Island (eggs), potential on San Miguel Island and Santa Barbara Island |
| Common Raven predation | Santa Cruz Island area (e.g., sea caves, Orizaba Rock) |
| Barn Owl predation | Santa Barbara Island, Santa Cruz Island |
| Island spotted skunk predation | Santa Cruz sea caves |
| River Otter predation | Nearshore rocks; Pt. Reyes headlands, Bird Island, Franklin Smith Rock – may occur elsewhere |
| Disease | Entire range – potential |
| Artificial light: Squid fishery, sport fishery and recreational boats | Everywhere squid fishing is permitted |
| Artificial light: Oil platforms | Channel Island breeding locations |
| Oil spill: Offshore energy platforms | Channel Island breeding locations |
| Oil spill: Vessels | Entire range |
| Organochlorine contaminants | Entire range |
| Ingestion of plastics | Entire range |
| Lack of Bio-security plan implementation | Entire range |
| Offshore wind energy development | Entire range |

# Appendix 1. Conservation objectives in order of priority (rankings) as determined by ashy storm-petrel working group members in 2016. A total of 19 working group members voted (30 members were invited to vote). Each member cast from 0-5 votes for each objective, with a total of 30 votes allocated to each working group member.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Category | Location | Brief Objective Descriptions | Priority | Feasibility | Prob. Of Success | Relative Local  Impact | Relative Impact – Range-wide | Cost Range | Anticipated Outcome | Totals |
| Reduce Predation | South Farallon Islands (B) | Within the next 5 years of the completion of this plan, complete the permitting process (e.g., EIS, etc.) and begin implementing identified methods to eradicate invasive, introduced house mouse from the South Farallon Islands in order to eliminate their negative impacts to ASSP and other native species of the FNWR. | 1 | 3 | 1 | 1 | 1 | 3 | Eradicate house mouse, reduce BUOW presence, increase ASSP adult survival | 59 |
| Index Monitoring | Range-wide | Development of an ASSP monitoring plan. | 2 | 2 | 2 | 1 | 1 | 2 | Standardized methods and approaches to ASSP data collection are developed (e.g. reproductive success, population estimates); long-term datasets are continued or initiated and trends are comparable across the range of the species | 54 |
| Artificial Habitat/Nest Structure | Santa Cruz Island | At appropriate ASSP nesting locations with documented predation issues, CINP and its cooperators will maintain avian predator proof artificial nest sites in order to increase the availability of protected nest sites and reduce the percentage of ASSP nest sites (adults, eggs and chicks) vulnerability to avian predation. | 1 | 1 | 2 | 2 | 2 | 2 | Reduce number of nest site vulnerable to avian predation | 30 |
| Reduce Predation | San Miguel Island (B) | Within 5 years of the completion of this plan, investigate the feasibility of conducting black rat (Rattus rattus) eradication on San Miguel Island. When feasible, begin rat eradication from San Miguel Island using the most appropriate and cost effective methods. | 1 | 3 | 1 | 1 | 2 | 3 | Eradicate rats from San Miguel and re-establish a secure breeding population of ASSP on the main island and protect existing colonies on adjacent islets | 30 |
| Survey and Research (Survey) | Channel Islands | Conduct surveys for nesting ASSP on San Miguel Island, Santa Rosa Island, Santa Cruz Island and Santa Barbara Island, Sutil Island and Anacapa Island (exclude San Clemente and Santa Catalina islands which have been recently surveyed) within 10 years of plan approval. | 2 | 2 | 1 | 1 | 1 | 2 | Population estimates are needed for “larger” colonies as current information is decades old; this information is important for providing baseline data for looking at populations across the range and importance observed in any trends data collected in the future | 29 |
| Reduce Predation | South Farallon Islands (A) | Within the next 2 years, the Farallon National Wildlife Refuge, Point Blue Conservation Science and other cooperators will work to reduce impacts of burrowing owl (Athene cunicularia) predation to the South Farallon Islands ASSP population by capturing and relocating burrowing owls. | 1 | 2 | 1 | 1 | 2 | 1 | Reduce ASSP adult mortality, increase survival, prevent ~50-100 ASSP from being depredated annually, slow population decline | 28 |
| Survey and Research (Survey) | At-sea survey (B) | Develop and implement at-sea survey methodologies specific for ASSP, likely utilizing adaptive sampling with a stratified random approach, to determine at-sea distribution and estimate world population size every 3 to 5 years. This objective likely would involve use of an aircraft to cover large areas in a short period of time. | 2 | 2 | 2 | 1 | 1 | 3 | Develop aerial survey for determining at-sea distribution and world population of ASSP; Obtain estimate of world ASSP population; essential to interpretation of trends data collected at colonies | 28 |
| Artificial Habitat/Nest Structure | SE Farallon Island | Farallon National Wildlife Refuge (NWR) will permanently maintain and when feasible enhance rock foundation walls on the Lighthouse Hill Trail, Auklet Trail, Helo Pad, and former Eggers House with dry stone construction in order to provide a minimum of 500 horizontal meters of potential nesting habitat (with 0.5 to 1.5 m of vertical elevation and minimum of 0.5 m width) with a moderate to high density of potential nesting sites. | 1 | 1 | 1 | 1 | 2 | 2 | Maintain current core breeding habitat. | 25 |
| Artificial Habitat/Nest Structure | Coronado Islands | Conduct a social attraction project at Coronado Norte, Coronado Medio and Islote Medio by installing at least 60 artificial nest structures and two accompanying sound systems on each island. | 1 | 2 | 2 | 2 | 2 | 2 | Re-establish breeding ASSP at Coronados; | 24 |
| Artificial Habitat/Nest Structures | Todos Santos Island | Conduct a social attraction project at Todos Santos Sur and Todos Santos Norte island by installing at least 60 artificial nest structures and two accompanying sound systems on each island. | 1 | 2 | 1 | 2 | 2 | 2 | Aid in preventing the loss of this colony as a nesting location | 21 |
| Reduce Predation | San Miguel Island Area (A) | Implement biosecurity measures at Castle Rock and Prince Island in order to ensure the early detection of black rats that may disperse from San Miguel Island and eliminate any dispersed rats before they establish a substantial population. | 1 | 2 | 1 | 1 | 2 | 2 | Prevent invasive species from establishing on this island | 21 |
| Survey and Research | Baja California Norte | Conduct surveys for nesting ASSP at Coronado, Todos Santos, San Martín, San Jeronimo, and San Benito islands within 10 years of plan approval. | 2 | 2 | 1 | 1 | 1 | 2 | Population estimates are needed for “larger” colonies as current information is decades old; this information is important for providing baseline data for looking at populations across the range and importance observed in any trends data collected in the future | 21 |
| Artificial Habitat/Nest Structure | SE Farallon Island | SE Farallon Island (B): Over the next 10 years, Farallon NWR will remove certain foundations of dismantled buildings on SE Farallon Island and repurpose the materials to create additional artificial breeding habitats, as appropriate and feasible. | 3 | 2 | 1 | 2 | 3 | 2 | Add breeding habitat for potential population increase | 17 |
| Artificial Habitat/Nest Structure | San Clemente Island – Seal Cove South Rock | At Seal Cove South Rock, the U.S. Navy, Bureau of Land Management, and their cooperators will install a minimum of 30 artificial nest sites in order to maintain an eventual minimum occupancy rate of at least 50% and a breeding success rate > 50% . | 1 | 3 | 1 | 1 | 2 | 3 | Increase number of nesting ASSP at San Clemente Island; provide additional predator-free habitat as this resource may be limited; prevent the loss of this colony | 17 |
| Reduce Predation | Coronado Islands Area (A) | In the next 3 years, design and implement a biosecurity strategy for these islands in order to ensure protection against invasive species. | 1 | 2 | 1 | 1 | 2 | 2 | Prevent invasive species from establishing on this island | 16 |
| Survey and Research (Survey) | Southern Humboldt, Mendocino, Sonoma, Marin counties | Conduct surveys for nesting ASSP at all accessible coastal rocks with suspected suitable nesting habitat from southern Humboldt County to Dillon Beach, northern Marin County (excluding central Mendocino County between Kibesillah Rock and Franklin Smith Rock where ASSP nesting was documented in 2012) within 10 years of plan approval. | 2 | 2 | 1 | 2 | 2 | 2 | Fill large information gap on ASSP populations in areas unsurveyed for years | 16 |
| Survey and Research (Survey) | Monterey, San Luis Obispo, no. Santa Barbara co. | Conduct surveys for nesting ASSP at all accessible coastal rocks with suspected suitable nesting habitat from Bird Rock, Monterey County to Point Conception, Santa Barbara County within 10 years of plan approval. | 2 | 2 | 1 | 2 | 2 | 2 | Improve knowledge of ASSP nesting on these nearshore rocks where little or no information is available | 16 |
| Reduce Predation | Santa Cruz Island Area (B) | CINP and its cooperators will begin attempting various management strategies to reduce avian predation at ASSP breeding locations with documented avian predation issues within the Santa Cruz Island area. | 1 | 2 | 2 | 1 | 1 | 2 | Reduce avian predation at impacted nesting areas | 12 |
| Survey and Research (Survey) | At-sea survey (A) – rangewide | Every decade or until ASSP specific survey methodology are developed and implemented, collate ASSP data from existing at-sea surveys using standardized protocols to determine at-sea distribution and world population size and collate information from non-standardized “bird-watching” trips. | 2 | 2 | 2 | 1 | 1 | 2 | Obtain estimate of world ASSP population; essential to interpretation of trends data collected at colonies | 11 |
| Reduce Predation | Todos Santos Island Area (C) | In the next 3 years, design and implement a biosecurity strategy for these islands in order to ensure protection against invasive species. | 1 | 2 | 1 | 1 | 2 | 2 | Prevent invasive species from establishing on this island | 10 |
| Survey and Research (Survey) | San Francisco and San Mateo Co. | Conduct surveys for nesting ASSP at portions of the South Farallon Islands (i.e., West End Island and Islets), the North Farallon Islands, and nearshore rocks along the mainland within 10 years of plan approval. | 2 | 1 | 1 | 2 | 2 | 2 | Enhance information on potential available nesting habitat at Farallons | 10 |
| Artificial Habitat/Nest Structure | San Clemente Island – Seal Cove Mainland | At Seal Cove mainland, the U.S. Navy, Bureau of Land Management, and their cooperators should conduct a trial effort to create a new colony in an accessible location at higher elevation along the edge of the bluff top that prevents flooding and is protected from avian and mammalian predators. | 1 | 3 | 2 | 1 | 2 | 3 | Establish a second secure breeding location; aid in preventing the loss of this colony | 9 |
| Reduce Predation | Santa Cruz Island Area (A) | At appropriate ASSP nesting locations with documented depredation issues, CINP and its cooperators will maintain avian predator proof artificial nest sites in order to increase the availability of protected nest sites and reduce the percentage of ASSP nest sites (adults, eggs and chicks) vulnerability to avian predation. | 1 | 1 | 2 | 2 | 2 | 2 | Reduce number of nest site vulnerable to avian predation | 9 |
| Survey and Research (Research) | Range-wide | Investigate the impacts to ASSP from artificial nocturnal lighting that is emitted from oil platforms and recreational and commercial vessels working near breeding colonies. | 2 | 2 | 1 | 2 | 2 | 2 | Likely multiple studies looking at light impacts on ASSP from various sources | 9 |
| Survey and Research (Research) | Santa Barbara Island area | Determine the current extent of predation on ASSP nesting on Santa Barbara and Sutil islands and investigate need for management actions (e.g., barn owl roost site alterations, mouse control, owl removals) to benefit the ASSP populations in the Santa Barbara Island area. | 2 | 1 | 2 | 1 | 2 | 2 | Determine impact of avain predation on ASSP at this island | 8 |
| Survey and Research (Research) | Santa Cruz Island area | Determine the current extent of avian predation on ASSP nesting in the Santa Cruz Island area (particularly at Bat Cave and Orizaba Rock) and investigate need for management actions (e.g., barn owl roost site alterations, common raven mitigation) to benefit the ASSP populations in the Santa Cruz Island area | 2 | 2 | 1 | 1 | 2 | 2 | Determine impact of avain predation on ASSP at this island | 7 |
| Reduce Predation | South Farallon Islands (C) | Within 5 years of the completion of this plan, determine the extent of western gull (Larus occidentalis) predation on ASSP populations at the South Farallon Islands. If warranted and feasible, implement management options to reduce predation to levels that result in the projection of a stable ASSP population based on population index values obtained from mist-net capture studies. | 1 | 3 | 2 | 1 | 2 | 2 | Quantitatively evaluate gull predation impacts, reduce ASSP mortality, increase survival | 6 |
| Survey and Research (Research) | Range-wide | Investigate the impacts of offshore wind energy development projects proposed off the California coast on ASSP. | 2 | 2 | 2 | 1 | 1 | 3 | Provide essential information to inform the BOEM lease and environmental permitting processes for offshore wind energy development | 6 |
| Reduce Predation | Coronado Islands Area (B) | In the next 5 years, assess the status of common raven, barn owls, and peregrine falcon at Coronado Islands and examine impacts of predation on ASSP adult survival and breeding success. Determine if avian predation is a factor limiting population size. | 2 | 2 | 1 | 1 | 2 | 2 | Obtain important information needed on avian predation in order to advance management and conservation of ASSP | 2 |
| Reduce Predation | Todos Santos Island Area (D) | In the next 5 years, assess the status of common raven, barn owl, burrowing owl and peregrine falcon at Todos Santos Islands and examine impacts of predation on ASSP adult survival and breeding success. Determine if avian predation is a factor limiting population size. | 2 | 2 | 1 | 1 | 2 | 2 | Obtain important information needed on avian predation in order to advance management and conservation of ASSP | 2 |
| Reduce Predation | Todos Santos Island Area (A) | Create a buffer zone of a minimum of 30 m adjacent to each natural and artificial ASSP nest, as determined during the 2015 breeding season in which WEGU nests are removed annually in order to decrease depredation of ASSP. | 1 | 2 | 2 | 1 | 2 | 2 | Reduce predation of ASSP visiting or breeding in nesting areas; | 1 |
| Reduce Predation | Todos Santos Island Area (B) | Reduce the total breeding pairs of WEGU to 8,800 breeding pairs within the next 5 years and keep the WEGU population at this level over the next 10 years. | 1 | 2 | 2 | 1 | 2 | 2 | Reduce WEGU population; reduce predation pressure on ASSP nesting in this area | 1 |

Note: Two additional objectives (listed below) were added by a member of the working group late in the process of writing this plan. No other members of the team voted on these objectives and thus they are not included in the above table at this time. Although these items may be warranted to be included in the plan, they were unable to be incorporated into the plan fully due to the time constraints associated with completing this plan and the lack of input from other members of the working group. They are included here in an effect to be inclusive and complete but with the recognition that these objectives were not fully vetted by the working group.

1. Conduct a genetic study to determine relatedness of coastal and offshore colonies.
2. Determine population size, partitioning between breeders and non-breeders using the same standardized techniques at all major colonies. (Note: This is similar to what is proposed in the Index Monitoring program objective).